3345 ① tomatoes
② tomato culture
③ " production
④ soil preparation
⑤ " sterilisation
⑥ tomato seedlings
⑦ tomato plant feeding
⑧ " watering
⑨ defoliating ⑩ tomato pests
⑪ tomato diseases ⑫ tomato plant

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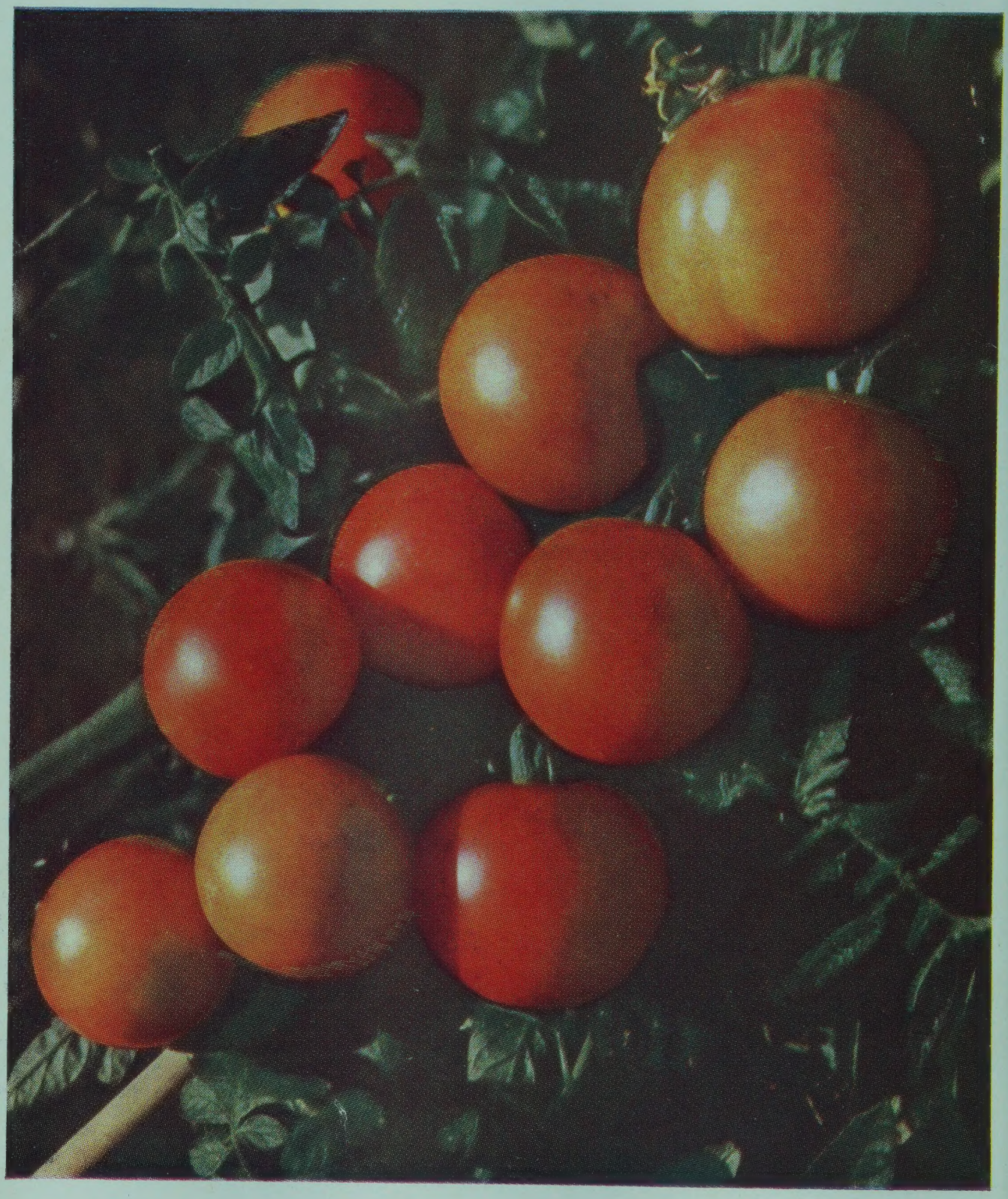
TOMATO CULTURE
BY
MODERN METHODS



(Shell)

The Glory of Ripening Tomatoes

TOMATO CULTURE BY MODERN METHODS

by

F. W. LOADS

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1

TOMATO CULTURE

Botanical Note:—Lycopersicum Esculentum (Love apple; Tomato). Natural order Solanaceae. Tender annual. First introduced 1596. *Fruit variously shaped. Red, yellow, purple or white; edible.*

ALTHOUGH the tomato plant has been in this country for nearly 400 years, it is regarded by many as a difficult plant to grow. This is a fallacy, as the tomato seeds germinate well, and the seedlings emerge from the seed coat strong and healthy. It is very often only the subsequent maltreatment that makes them fade away like the mist before the sun.

One has only to observe the health and strength of self-grown tomato plants to appreciate how strong and robust they really are, and it is my firm opinion that many of the failures which occur are due, amongst other things, to coddling, and insufficient fresh air.

Of course, the growing of any sort of plant in a greenhouse is entirely contrary to nature, but the tomato plant takes more kindly to these artificial conditions than most other food plants. In fact, I know of no other crop which gives such a heavy return for the space it occupies, either outdoors or under glass.

I am of the opinion that the success of the ultimate crop is determined long before the seed packet is opened. For me, the tomato season starts the moment the last fruit of the previous season's crop is gathered. It should

be unnecessary to say here, that the tomato—the queen of the summer greenhouse crops—should have the sole use of the greenhouse for herself.

Unfortunately however, this is not always possible, but the tomato is sufficiently adaptable to grow with other vegetable crops and even flowers, requiring the same comparable, or even slightly different cultural conditions.

However as my main consideration is to offer advice on producing good crops of tomatoes, I do not intend to concern myself with the fate of any other possible occupants of the greenhouse. This being so, a lethal dose of flowers of Sulphur is my first burnt offering, and the only sacrifices—provided you get out in time—are the myriads of disease spores and insect pests that try to harm the plants.

This method of fumigation may be used in any type of greenhouse, provided it is reasonably airtight when the doors and ventilators are closed. If the cracks and openings are over large, these should be plugged up with cotton wool or old newspapers, to make the fumigation as effective as possible. A point to watch particularly, is the frame in which the ventilators fit, and the point where the eaves glass rests on the framework of the house, as deliberate air spaces may have been made here by the builders. If your greenhouse is attached to a dwelling house, then it is advisable to take additional precautions or you may not be very popular with the rest of the family ; and if there are any doors leading from the house into the greenhouse, seal the joints by running adhesive tape over them to make them as gasproof as possible.

Although the fumes from burning sulphur are not deadly to human life unless in a concentrated form, they can be very unpleasant and will tarnish silver and other

metals badly. These fumes however, are fatal to nearly all forms of insect life, and *also to plant life*, and will kill most fungus spores. This being so, if you have any other plants in the greenhouse for which you have any regard, clear them out.

The practice of removing plants for fumigation and returning them after treatment is not satisfactory, as pests and diseases may be immediately re-introduced on the returned plants. Dormant vines, fig trees and peaches are not affected by the fumes from burning Sulphur.

As soon as the last tomato fruits have been gathered, get them out of the greenhouse—as far away as you can—especially if the plants have been attacked by white fly. Apart from the tomato fruits however, do not remove a single thing, not a piece of string, a leaf or a cane.

If you have not already done so, calculate the cubic capacity of your greenhouse—if a span roof multiply the length by the breadth by half the height to obtain this. A lean-to of course, will be approximately half this capacity.

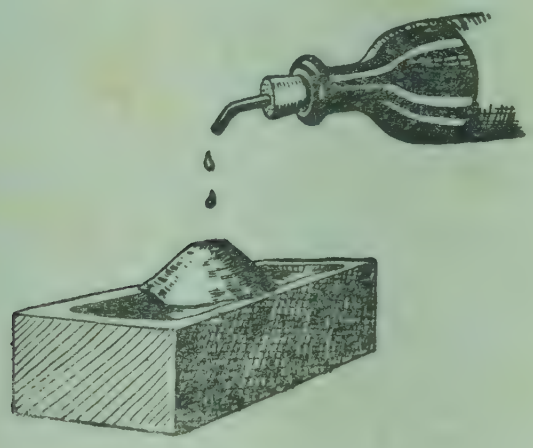
Flowers of Sulphur may be obtained cheaply from any chemist, and it is better to overdo the quantity than to use too little. The amount required is approximately 1 lb. of flowers of sulphur for every thousand cubic feet of space. The method of fumigating is as follows :—

Make small conical heaps of sulphur each containing about a cupful, and place these on a piece of slate, or in the hollow side of a brick. This is necessary if the floor of the greenhouse is tiled or cemented, as the sulphur melts when burning, and sticks worse than toffee.

On no account place the sulphur to be fired on wood, or on a wooden bench, or the whole greenhouse may be burned out.

These precautions are not so necessary if the floor is an earthen one; all the same, remove the burned out sulphur the morning after fumigating.

To help things along put a few drops of lighter fuel or petrol on each heap of sulphur, then starting at the far end of the greenhouse set light to the heaps and get out as fast as you can and shut the door. Do not enter, or allow



Put a few drops of lighter fuel on each heap of sulphur.

Fig. 1.

anyone to enter for several hours after the heaps have finished burning. The burning sulphur will not only destroy all the fungus spores but all insects as well, and it will in addition thoroughly dry the foliage of the old tomato plants, so that these are disposed of easily.

An alternative method of fumigating is to dissolve two ounces of permanganate of potash in a glass or enamel bowl containing four ounces of commercial formalin, better known as Formaldehyde. Pour the formaldehyde into the container and drop in the crystals of permanganate and get out quickly. Do not linger to watch them dissolve. For preference all fumigation should be done in the evening, as generally at this time there is less wind to create a draught, which would disperse the concentration of the fumes.

The first job next day will be to open the door and a

few minutes later open all the ventilators to allow the greenhouse to air thoroughly before commencing to work in it. All the leaves and stems of all the old plants will be dry and yellow, and provided the plants are free from disease they can be used safely on the compost heap. Any green tomatoes remaining should be cut off and hung up to ripen or used in chutneys or pickles.

To remove the haulm, cut the stem and the supporting string about six inches above the soil, thus allowing the stem to slip down the string, leaving the removal of the stump until last. Do not throw the haulm down on to the floor to pick up again, it is surprising how much work can be saved by adopting some sort of system. Have a wheelbarrow handy, and carry the haulm directly on to the barrow, and after all the old stems have been removed and the leaves picked up from the floor, the string can then be removed. If the plants have been tied up as indicated in a later chapter the string can be removed by a single pull, and tied up neatly in conveniently sized bundles to be available for tying up anything else during the following season, with the exception of tomatoes. For whatever the condition of usefulness of the string may be, it should on no account be used again for this purpose, as there is just a chance that some form of disease may remain on the string and be transferred to the young plants the following season. In any case, exposure to sunlight makes the string rotten and at a critical moment, it may let the plants down when they are heavy with fruit.

The roots may now be pulled up by the six inch handle of stem which was left on, and around this should come away the lower portion of the supporting string, which is bound to be rotten, and, as it contains a knot, is useless for tying again. Stack the roots and short pieces of

string away from the greenhouse until thoroughly dry, then burn out of harm's way.

All portions of leaves, raffia, string and debris of every sort should be removed carefully from the overhead wires, for tidiness and hygiene.

The removal of the plants and stump should be followed by a thorough scrubbing down of every inch of wood and glass work, and if possible a mild disinfectant should be used in the water. Use one which is harmless to the hands. It should not be forgotten that ordinary soft soap by itself is an excellent cleanser. Use a scrubbing brush with a long toe on, and finish the job by thoroughly syringing, or hosing all the glass and woodwork. This is an excellent time to paint all the woodwork inside, as it is possible that this is the only time of the year when the house will be entirely empty.

Make a thorough job of this scrubbing down, for the escape of only a few white flies or other vermin may mean costly fumigation during the following season, and possibly loss of crop. Apart from any cultural consideration, it is obvious that it does pay from the £ s. d. point of view to start clean. Particular attention should be paid to the overlap of the glasses, as this often becomes dirtier with each succeeding year, and is exceedingly difficult to clean once it has been neglected.

An old stirrup pump comes in handy for this job, as it may be directed with considerable force down between the glass. Particular attention should be paid to the joints of the framework, and especially to the cross ties, as it is here that red spiders will try to spend the winter.

Whilst this work of cleanliness is going on it will pay to clean out the outside gutters, down pipes and water tanks. There is a particular reason for extreme cleanliness at this time of the year. Following the normal

reenhouse routine, chrysanthemums invariably follow omatoes, and at no time later on in the season will the reenhouse be so entirely empty, unless more than one reenhouse is available. As however in small gardens or n allotments one greenhouse is generally all that is vailable, it pays to have a short gap between the end of he tomato season, and the beginning of the chrysan-hemum season, for when chrysanthemums are housed hey will remain in position possibly until well into the ew year. By this time cuttings will be forming and eedlings will be starting in boxes, so at no other time will t be possible to give a thorough fumigation to the reenhouse.

Water Tanks.

Cement tanks should receive an annual scrub out and a coating of slurry or cement wash applied with a brush. Slurry is simply a cream like solution of pure cement and water.

Galvanised tanks should be drained and scrubbed, and wooden barrels and tubs should be scrubbed and painted with a bitumen paint, which not only disinfects but is an excellent preservative. Bitumen paint does not give off fumes, and is not harmful to plant growth, even when the temperature is raised as in a greenhouse.

This fetish for cleanliness may appear to be carrying things to extremes, but I can assure you that prevention s very much cheaper than applying remedies later on. All this cleanliness goes for nothing if it is not thoroughly done, and this means not only the cleanliness of the greenhouse, but also the pots, boxes and even the hands of the operator.

By clean I mean of course, free from any likelihood of any contagious plant diseases. I would stress again that

absolute cleanliness is essential if tomatoes are to be successfully grown over a period of years, without having to spend time and money on combating even one of the many diseases which can easily be conveyed to tomato plants in this way. Cleanliness and attention to greenhouse hygiene quickly becomes a habit, and in the succeeding pages, I shall continue to stress this point even to the extent of suggesting that a bowl of disinfectant is kept in the greenhouse in which the operator can dip his hands every time a cultural operation is performed.

It is a golden rule in gardening never to use a dirty pot to pot a clean plant, for not only do such pots become surface dirty with green algæ but the porous clay gets filled up too. Disease germs breed in such places, and the mechanical efficiency of the pot becomes impaired.

After being used for only one year, the unwanted food from the roots of the plant is absorbed by the pot, together with an assortment of other chemicals, so much so, that it is often possible to see chemical deposits which permeate the sides of the pot appearing on the outside in the form of a white deposit. There is no need to use soap for scrubbing pots, plain water, a good scrubbing brush and elbow grease are all that are necessary.

If possible, allow the pots to soak for about two hours before scrubbing, but do not leave the pots in water for any length of time as they become soft and easily broken. The reason for allowing pots to remain in the water is to allow the chemicals to soak out into the water. It goes without saying that water should be continually replenished if a large number of pots are being scrubbed. After the pots have been scrubbed, do not put them one inside the other until they are quite dry, because like

ass tumblers they have a nasty habit of sticking gether. Stack them together one on top of the other ıtil they are dry enough to put in store.

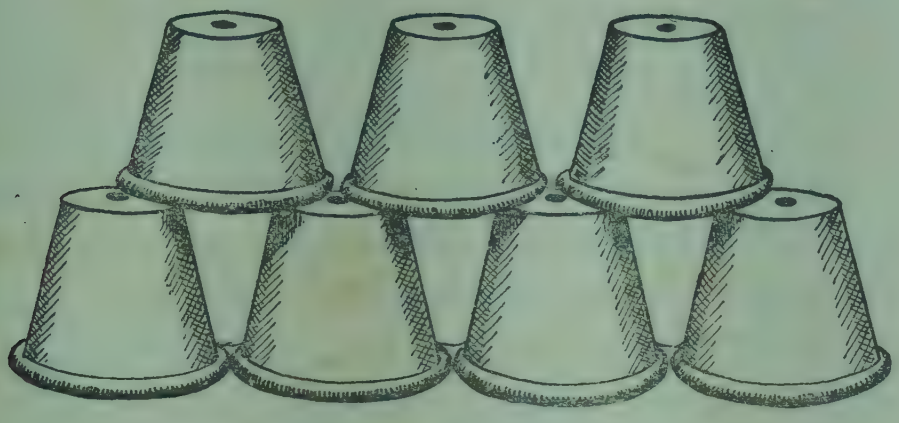


Fig. 2. Stacked pots after scrubbing.

When storing do not put small pots inside larger ones, ıt keep the various sizes separate. Very dry pots, and ew pots should receive a good soaking before use, as if ants are potted up into new pots without soaking, the ots will actually absorb moisture from the soil, and the ant will continually need watering, to its great detri- ent. Where possible leave them outside for at least two onths before use, but if they must be used straight vay, soak them in water for at least several hours.

ATER TANKS.

Although water tanks have been mentioned earlier, I nsider them of so great importance to the well-being of mato plants and other seedlings in their early stages, that few more words will not come amiss.

Whilst cold water in itself is not so harmful to plants as ay be supposed, the shock of cold water under certain nditions may render the plant liable to secondary seases, just as in the same way pneumonia may follow ock in human beings.

Provision should be made to raise the temperature of water used for young plants, either by adding warm water or positioning the water tanks. Do not use a hose pipe on young plants.

During the summer and early autumn months the water direct from the tap may easily be warmer than water in the greenhouse tank, especially if this is sunk into the ground. Water in these tanks is notoriously cold. Further more, unless certain precautions are taken, such as securely covering the top of the tank against drip from the benches, then I believe the water in such tanks can definitely be harmful to young tomato plants. In fact, I blame infections from such tanks for much of the damping off which takes place with all seedlings in the early part of the year. Many of the fungi which cause the " damping off " of seedlings are water borne, and if any plant has been infected during the growing season, the water may drip through into the tank carrying the spores of the disease, and this may in turn again be watered to seedlings. There may not be any sort of infection for years, and then suddenly seedlings and young plants collapse and die, and it may be weeks before the true source of the trouble is suspected.

The water in tanks sunk into the ground is very difficult to warm, unless a warm pipe is run through it, or an electric immersion heater used. The temperature of the water will also vary considerably especially if, as is usual, the water from the roof runs into it. The warm water rises as the colder water from the roof runs into it. and this warmer water simply goes down the overflow pipe, so that sometimes the water is warm, and sometimes extremely cold. As the greatest intake of water is generally during the colder months of the year due to snow and heavier rainfalls, the seedlings are bound to suffer.

In greenhouses with fixed benches it may be argued at space and expense is saved if the tank is put under e bench, but if this space is saved at the expense of od seed, plants, time and labour, then there can be no ving at all. On the other hand, where crops like matoes are grown in the ground, then this argument es not hold good, because generally speaking a sunken nk occupied as much ground space as any other type, sides being more liable to contamination. A tank of y material, wood, iron or concrete is best above ground, d a waterproof top should be fixed if plants are to nd on top of it, so that no drips or the drainings from e plants can run into the tank.

It is realised that where space is limited, a board on a nk makes a convenient shelf for plants or boxes, but as e diseased seedling can infect thousands, it may prove stly space saving. It may be thought that I have placed due stress on clean water, and you no doubt can quote ses where no precautions have been taken and nothing s happened. Children play "last across the road," t this often ends in tragedy. My maxim with tomatoes " never take a chance."

As all water tanks need thoroughly scrubbing out at st once a year, it is best to arrange a plug and an erflow pipe, and before any tank is arranged in a eenhouse, provision should be made for draining away y surplus water. This is essential, especially if roof ter or rain water is used to fill up the tank. In many tricts rain water is preferable to tap or well water, and ould be collected whenever possible. If this is not lected for use in the water tank in the greenhouse, it ould be drained off somewhere, for if this is not done, may seep under the greenhouse wall and make the beds terlogged, or even undermine the walls with dire

results to house and crops. When no properly constructed drain is available to which the surplus water may be drained, a rubble drain may be made to take the water to a sump in the garden.

An excellent arrangement for draining or to provide the overflow without making two holes in the tank is as follows. Procure a tapered socket of brass, this may be of any suitable diameter, but one about the size of an ordinary bath plug hole will do nicely.

Fix this in the lower corner of the tank, either in the concrete or the metal forming the flooring of the tank. A hollow plug of brass should fit snugly into the socket. Drill or braze to this plug a piece of iron piping so that the length of the pipe when inserted into the socket will determine the height of the water in the tank (see illustration). The arrangement is very simple; the water rises to the top of the pipe placed in the plug hole, and simply runs down it as an overflow. The advantage of this, is that in addition to providing an overflow without any extra piping or hole boring, the tank may be emptied very easily and quickly, by simply pulling the pipe out of the socket, and allowing the water to run down the plug hole. Where the volume of the water in the tank is greater than the drain can take, the flow may be easily controlled by popping the tapered end of the pipe back again into the socket. The provision of means of draining the tank quickly is important because unless some sort of arrangement has been made, there is sure to be a good bit of reluctance about emptying it, especially if the water has to be baled out. Nothing should deter the annual cleaning.

The task of cleaning out a tank is best done during the months when the period of greatest rainfall is expected, especially when it is difficult or inconvenient to fill it up

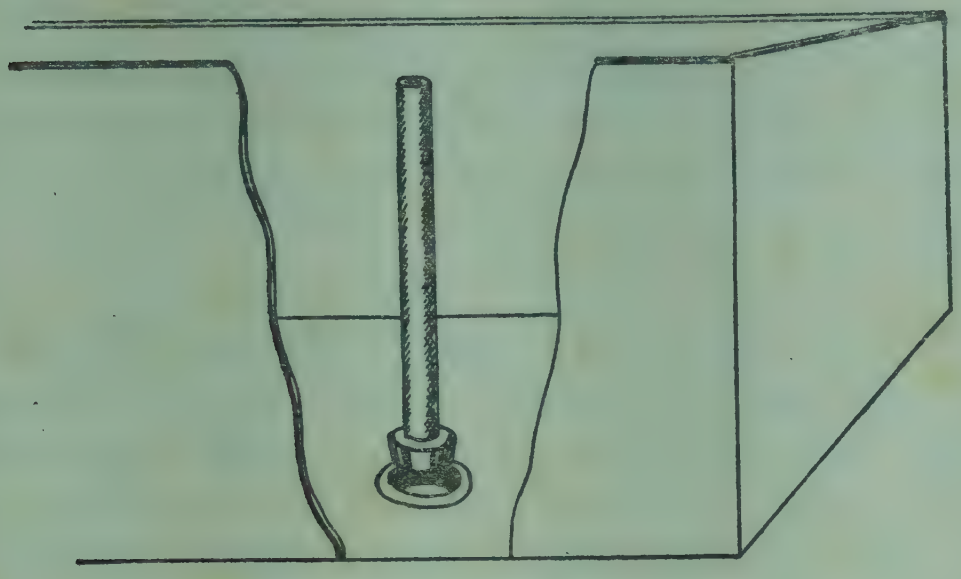


Fig. 3.

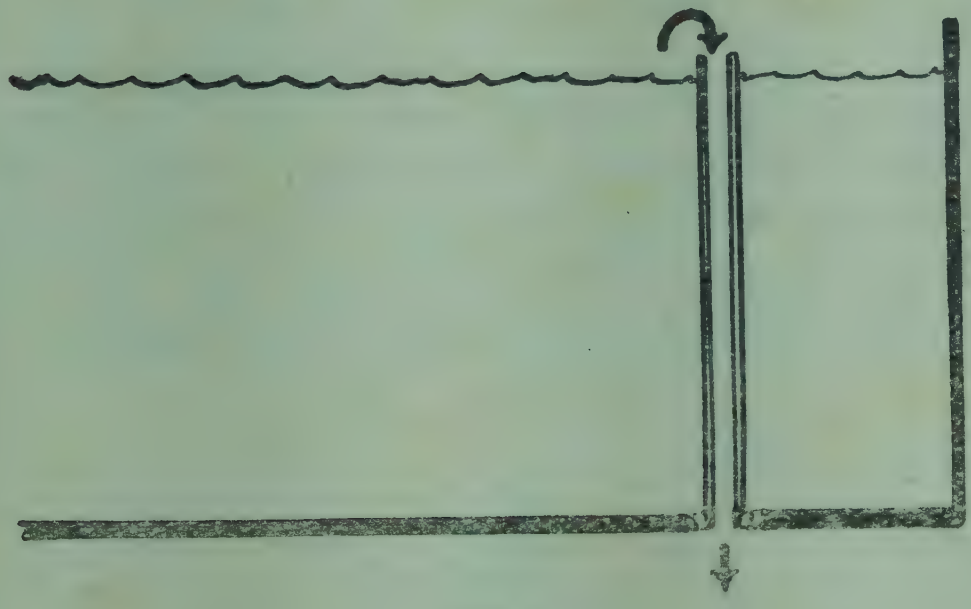


Fig 4.

y any other means. Not all greenhouses on allotments ave water laid on, so it will be found better to do this ob when less water is being used, and the heaviest ainfall is expected, so that the tank will be quickly filled p again. This is generally during late Autumn or uring the Winter months.

One of the drawbacks of using rain water is that a udden heavy shower may cause all the aired water in the

tank to rise, and run down the overflow pipe. This can be overcome by using the simple device shown in the illustration which allows the excess water to be tipped into an outside reserve tank or down a drain.

Seed Boxes.

Seed boxes are another potential source of infection, for as a rule scant attention is paid to these until they are actually required for use. Under such circumstances their life is short, and at pricking off time there is generally a shortage of sound seed boxes. This is particularly annoying because if plants are sold as a side line it may cause a definite loss of revenue, and at the best may be an inconvenience. Well preserved boxes are an asset, especially when wood is in short supply, and timely attention will keep wooden boxes only a quarter of an inch thick in good condition for at least 10 years. Even if new boxes are readily available, it is essential that all seed boxes should be kept clean and free from disease. After being emptied in the early part of the year, boxes

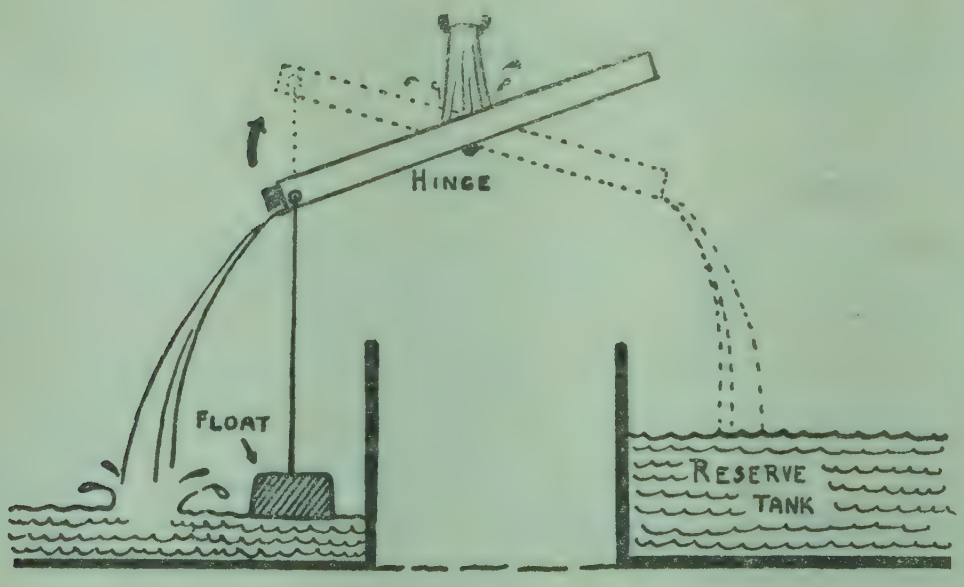


Fig. 5. A simple device for coping with excess water.

should be brushed out, and stored in a dry shed. They can then be attended to at leisure during the winter months when little or nothing can be done in the garden. For sterilising and preserving seed boxes, Bitumen paint has no equal. This may be obtained in various qualities from 3/6 to 9/6 per gallon, and if variation from black is required, bitumen paint can be had in many colours. Black however has the best preserving qualities. Keep the air from it when not in use, and apply as for ordinary paint.

2

SOIL FOR TOMATOES

TOMATOES grow pretty well in any sort of soil, light, heavy, medium, deep and shallow, in fact, they will grow without any sort of soil at all (see soilless culture). So don't be discouraged from growing tomatoes, because you think that your soil isn't just right, as fortunately, there are very few soils that cannot be put right.

If you have any choice in the matter, a rather heavy greasy loam should be selected, and the main reason for selecting this, is because of the greater reserve of food material in it. Quite good results, and in some cases excellent results, can be had from growing them in ordinary garden soil, and as this book is for ordinary fellows, with just ordinary gardens, and is not primarily intended for the professional gardener with a good heap of rotted turf at his disposal, I intend departing from the "well rotted turf" tradition.

Consider first the man with a small greenhouse who has never had the chance of getting a barrow load of really good new turf. It gets tiring to be continually reading about stacked turf and turf heaps, and just what soil should be used for tomatoes. Most people of course, know what should be used, but they are just unable to get it, especially if they happen to live in or near a large town. If it is of any consolation, much of the so called turf or top spit which is sold as turf, would be better left on the moor or quarry top, as some of this is hardly good enough to grow weeds. Even in the country, supplies of well rotted turf are scarce, and when turf is removed from

building sites, the corporation department or contractor generally has the first claim.

Ordinary garden soil taken from a vegetable garden that is in good heart (this is the sort of soil that has grown, or will grow a decent crop of anything else) is not bad material to start with, and soil of this nature can generally be found in any garden which is big enough to contain a greenhouse. The soil should be taken from a part of the garden that has not carried a hungry crop such as Savoys or Sprouts. For preference, the soil should be taken from an area where peas and beans have been grown. Be most careful however to avoid taking this soil from the site which carried potatoes the year before. Tomatoes belong to the same family as the potato and some virus diseases which attack the potatoes may take a fancy to the tomatoes. This point has not yet been fully cleared up, but you would be well advised to take no chances.

There will be very few clods or big lumps in ordinary garden soil, so that any sifting that is necessary for the potting of small plants may be done after mixing.

For sowing seeds, and for potting small seedlings, the following mixture will be found to be quite satisfactory. To every four bucketsful of soil (an ordinary household bucket is two gallons) add one bucketful of finely granulated peat. To this soil and peat, add a half a bucketful of sand (this should be as coarse as possible) and a five inch potful of finely ground lime rubble, and finally add one heaped dessertspoonful of Superphosphate of Lime.

Your ingredients should now be :—

4 buckets garden soil.
1 bucket granulated peat.
½ bucket of coarse sand.
5 inch potful of Lime rubble.
1 dessertspoonful of Superphosphate of Lime.

The peat should be finely ground—stipulate sedge peat for this purpose. Peat moss which is sold in bales for bedding down horses, or to put in the scratching shed for chickens, is of little use for this job, besides taking hours to put through a sieve.

Many firms now offer sterilised potting soil which is already mixed and may be delivered to your door ; this is well worth buying. If you prefer it, use the John Innes compost, but as this formula is based on the use of virgin soil, half its value may be lost if ordinary garden soil is used. If you favour these formulas, stick to them in their entirety, and do not make substitutes and expect the same results.

Mixing.

Turn the whole heap over two or three times, taking care that the sides of the heap are turned to the middle each time, and if at all possible, allow this to stand in an open shed or airy outbuilding for a week or ten days, and then turn thoroughly again. This turning appreciably raises the nitrogen content of the soil, a fact which will be beneficial to the young seedlings. After the final turning, pass the required amount through a quarter inch mesh sieve, keeping the lumps that will not pass through the mesh to one side. These can be used at the bottom of pots or boxes to assist drainage.

As the mechanical side of the soil is as of much consequence to the seedlings as the chemical content, the soil should feel smooth and silky to the touch, and with experience, you will be able to tell if the texture of the soil is right by the feel of it.

No matter how good the chemical content of the soil may be, unless the texture of the soil is right seeds will not germinate, as the following conditions are essential before germination can take place.

Sufficient water must be present for the seed to absorb, and this helps to start in motion the process of germination. The soil must also be sufficiently open to allow air to reach the seeds, this condition being provided by the peat and the sand. The peat also acts as a sponge in holding sufficient water without being saturated. Warmth is also necessary to assist the moisture and the air to activate the hitherto dormant seed.

The soil is now ready to put into the boxes to accommodate the seeds. For this purpose, boxes are preferable to pots, simply because there is more room for the roots, and the soil does not dry out so quickly. Pots are generally used when only a very small number of plants are required, or to test germination.

All boxes used for seed sowing should either be provided with drainage holes, or the wood which forms the bottom of the box be so arranged that little slits are left between them. When boxes are being made from dry wood, it should be remembered that the wood will swell appreciably when wet, and if sufficient space is not allowed the cracks will close up. Box bottoms should not consist of a large single piece of wood, as they may swell and wrinkle with disastrous results to young seedlings. Boxes well coated with bitumen paint will not swell so much as raw unpainted wood.

DRAINAGE.

To assist the drainage already supplied, put some of the rough material which would not pass through the sieve into the bottom of the seed box. Do not leave the pieces too big, or the roots of the young seedlings will get into them, with the result that when it comes to transplanting, the lumps will not draw freely from the box and the tiny roots will get broken, thus checking the plant. Pieces about the size of a marble are just about right.

If the seed box is about three inches deep, then an inch of rough material is sufficient, and if there is not enough of this material to go round for all the boxes, then eke it out with peat.

Next, put the soil into the box on the top of this rough stuff, and work it down firmly with the ends of the fingers, paying particular attention to the corners of the box. If this point is not properly attended to, the soil will sink at the corners when watered, causing a sloping surface which will allow the soil in the seed box to dry out quickly. If however, the whole is evenly firmed, it will remain moist throughout its bulk until the seedlings are nicely up.

Preliminary smoothing is best done with the fingers, and followed up with a smoothing board. This smoothing is of particular importance, for at this stage, the soil should not be pressed and paddled down as is so often done. The best gadget that I know for smoothing the soil, is a piece of flat wood of any convenient size—say six inches by nine inches—and about an inch thick. One

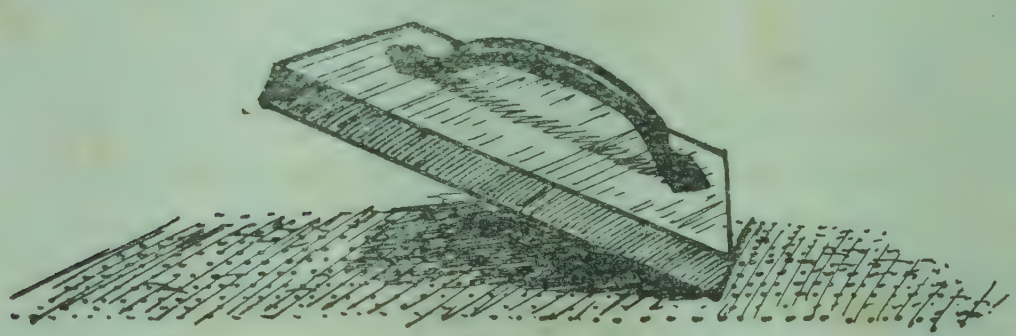


Fig. 6.

surface at least should be planed smooth and painted, as this prevents the soil from sticking to it and pulling up. To make it easier to handle, screw an old door handle or a knob on the back of it. A handle is to be preferred as this gives a better control.

This board is used for smoothing down the surface of he soil with a light sweeping motion. The pressure pplied should be little more than its own weight, as its se is for levelling and not for rolling or ramming.

After filling, the box is ready for a good soaking using watering can with a medium to fine rose. Water berally, but be sure that the box stands level, or loose articles of soil and peat will float to the low side. Don't rget too, that there is a right and a wrong way to use he rose on cans.

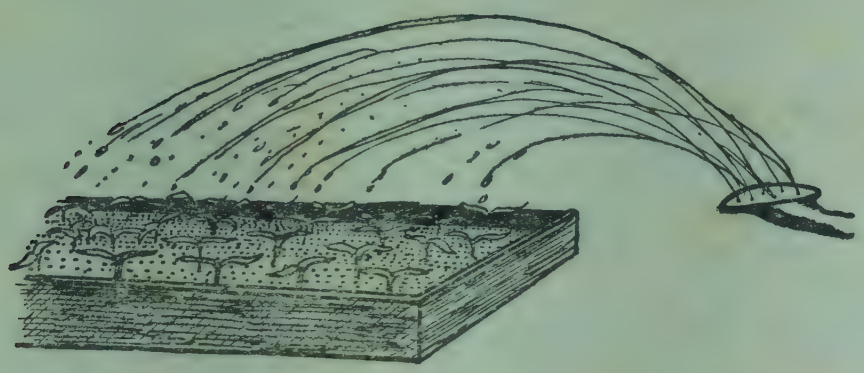


Fig. 7. The right way to water seedlings.

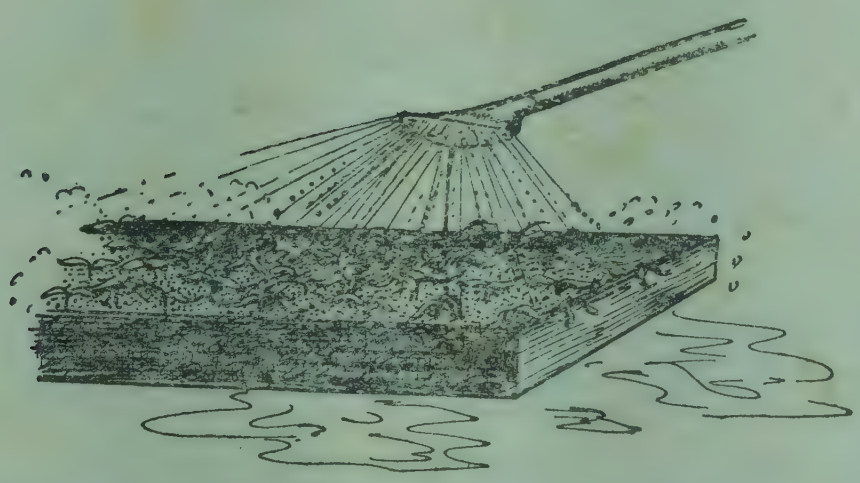


Fig. 8. The wrong way to water seedlings.

If possible, let the soaked boxes stand an hour or two, s this gives time for complete saturation, and what is

more important, allows air to follow the excess water, which drains out of the boxes. Even if the soil is moist when put into the boxes, it is still necessary to soak the soil, then it will not require watering until after the seedlings appear.

Soil Blocks.

Soil blocks made from prepared soil may be used instead of using boxes of soil or pots for sowing the seeds and rearing the plants.

The blocks should be prepared from a mixture containing a large proportion of decayed organic material, such as well rotted compost or old manure as the technique is entirely different from pot culture. Further experiment has shown that soil blocks can be made very successfully from John Innes Potting compost, 7 parts soil, 3 parts peat and 2 parts sand.

In this case the material must be able to hold together, allow air to enter, and at the same time allow the tiny roots to penetrate it. With no pot to hold the mass together, a wetter mixture is essential.

The advantage of this method over potting, is that there are no pots to be bought, no dirty pots to be washed and consequently no disease carried from one year to another.

The material enriches the soil when the block is planted and considerable labour is saved because the seed is sown directly into the block and no transplanting is necessary.

To make soil blocks with the tool illustrated, all that is needed is a mixture as described above, passed through a quarter inch riddle, and damped to the point of wetness.

Press the cylinder into the soil until about $3\frac{1}{2}$ inches of compost is contained in it, use the plunger like a rammer

to compress the compost into a block, which is expelled by pushing out the block with a rotary motion.

Sowing the Seed in Soil Blocks.

Stand the blocks on benches or in boxes and fill the hole in the block with a 50–50 mixture of sand and granulated peat. Water this through a fine rose which will cause this light material to sink a little. Place the seeds on this, and sift some more of the same mixture on the seeds, and nothing more need be done until the plants are big enough to plant out. The same tool can be used for planting out the blocks. This will appeal to older people or those who don't like bending.

Sowing the Seed.

Different people have different methods, but my way of sowing tomato seed is as follows. The soil has already been soaked, and allowed to stand for several hours to give it a chance to settle down, as well as allowing the surface water to drain off. When preparing a lot of seed boxes just stand them one on top of another, one lengthways, one crossways and so on. Soil of the same mixture as in the box, but which has been passed through $\frac{1}{8}$" meshed sieve is scattered evenly over the surface, and smoothed by trailing one edge of the smoothing board scraper fashion over it. This scraping motion gives a fine smooth even surface, but does not glaze it, and provides a satisfactory soil cushion on which to sow the seeds. At no time, is the soil patted down. It should be remembered that the radical or tiny root is emitted first from the seed, and if this finds a hard surface, it will take the line of least resistance, and will use this hard surface as a spring board and push the seed out of the top of the soil.

Labelling.

It is a good plan to write the labels before opening the

seed packets, laying each label in the box selected for that particular variety. On no account, use old dirty labels. A dirty or infected label may undo all the good work which has been put into cleaning the boxes and sterilising the soil.

Sowing the Seed

Empty a few seeds into the palm of one hand, and using the finger and thumb of the other hand, place each seed singly about one inch apart in rows, starting along the long side of the box, and about one inch from the edge. The next row is an inch from the first one, but staggered in this fashion.

* * * * * *
* * * * *

This may seem a waste of time, but experience has proved that it is well worth the trouble, because it allows each seedling to be lifted without disturbing the roots of the others. Also in the case of infection "by damping off" disease, the infection will be checked because of the greater distance apart. Crowding seedlings in the seed box is simply asking for trouble.

After the boxes have been filled they can be covered with soil, either immediately after sowing, or they can be stacked and covered in one batch.

Covering the Seed.

The same mixture of soil that was used for filling the boxes may be used for covering the seed, but I suggest that it should be mixed with equal quantities of sand. Mix thoroughly, then cover the seeds to a depth of about $\frac{1}{8}''$, that is roughly the thickness of an ordinary 5 inch label. If this is the first time that you have covered tomato seed, leave the label lying flat on its back in the

eed box, and fill in the covering soil until it is level with he upper face of the label.

A useful gadget for covering all seed is to make a small ox 9 inches long, 6 inches wide, and 2 inches deep, with alf the bottom covered with wood, and the other half overed with perforated zinc.

Put a handful or two of the fine sandy mixture in this, nd sift it over the seed.

The half wooden bottom gives perfect control over the fting operation, as with a quick motion the soil in the fter can be tipped on the wooden bottom like shutting ff a tap.

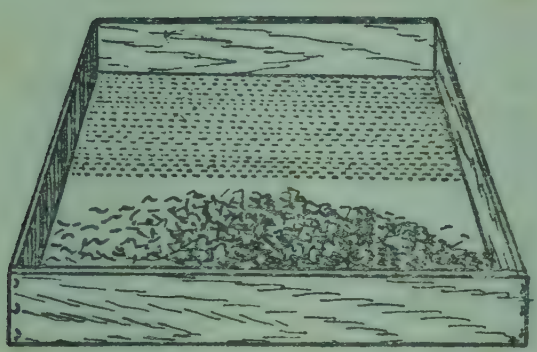


Fig. 9. A useful seed covering method.

You can then remove the label from the surface of the oil, and place it on its edge with its back to the side of the ox. Now, take your smoothing board, and press this ently over the surface of the freshly scattered soil. lthough this is the first time that pressure is exerted ith the smooth board, do not pound the soil. The idea s to get the soil pressed nicely round the seed, and to get he drier top covering soil into intimate contact with the oist body of the soil in the box. Pounding the soil down ard will puddle the wet soil, and will expel the air from it.

This may seem an awful lot of fuss to make over a few tomato seeds, but it is just as easy to learn good habits as bad ones. Such procedure will quickly become routine, and you will then have the satisfaction of a job well done, and the knowledge that you have done everything that can be done to give the seed a good start in life.

Germination.

Tomato seeds like others must have three things before germination takes place, AIR, WARMTH AND MOISTURE, and they will do better if they can get off to a quick start, by placing them in a fairly high initial temperature. 65 degrees is ideal if you can manage it. If it is not possible to maintain this temperature throughout the greenhouse, the seed boxes should either be placed in a specially heated propagating case, or placed at the warmest end of the greenhouse. It is not advisable to place the seed boxes directly on to the heating pipes, as this tends to dry the soil very quickly. If this must be done, turn an empty seed box upside down on the pipes, and place the full one on top of that.

Covering the Seed Boxes.

Many people suppose that it is essential for germination to cover the seed boxes with glass and paper. This of course is not so. Seeds will germinate equally well without either. Covering does not increase the darkness, as the seed already under the soil is in complete darkness. The real reason for covering with glass and paper is to prevent the rapid evaporation of the water from the soil in the box. Covering maintains the moisture content of the soil, and making it unnecessary to water the seed box until the seedlings have pushed well through the soil.

Watering the seed boxes between the time of sowing and germination should be avoided if at all possible.

For ease of handling, I find that sheets of glass covered with a thin coating of the same kind of blue paint as used for the dipping of electric light bulbs is far more effective, and is less trouble than messing about with sheets of paper. I prefer the coloured glass, because I never remove the glass from seed boxes until I observe the first signs of the seedlings coming through the soil. This may be regarded as heresy, but I can never see any point in conserving moisture under the glass, and then wipe it from the underside of the glass.

Water from the soil will condense rapidly on the underside of the glass in a warm greenhouse and is continually running back into the box day and night, so the few minutes when the glass is turned over or wiped dry can make little difference. Later, when the seedlings are up and likely to be affected by dampness, the glass has been removed. If glass is used for covering the seed box, care should be taken to see that it is not so tight a fit over the edges of the box that no air is able to reach the surface of the soil. If this happends, grey mould will form on the surface of the soil.

The actual time that it takes for the seed of a tomato to poke through the soil depends on several conditions, including the variety, temperature, the moisture content of the soil, depth of soil and the time of the year. It may be taken as a rough guide however, that in a temperature of 60–65 degrees F., it will take about 12 days to germinate during a normal February. It is always a thrill to see the little blue arched stems pushing their way through the surface of the soil, dragging the seed coat with them.

If the soil is in proper condition, the seed coat will become sufficiently softened, and will remain under the ground as the two seed leaves or cotyledons withdraw from them. If the seed coat is withdrawn from the soil

attached to the cotyledons, then the soil has been kept too dry, and considerable difficulty may be experienced in removing the now rapidly hardening seed coat. No attempt should be made to pull this off with the fingers. Syringe with a very fine spray, using water as hot as would be normally used to wash your face.

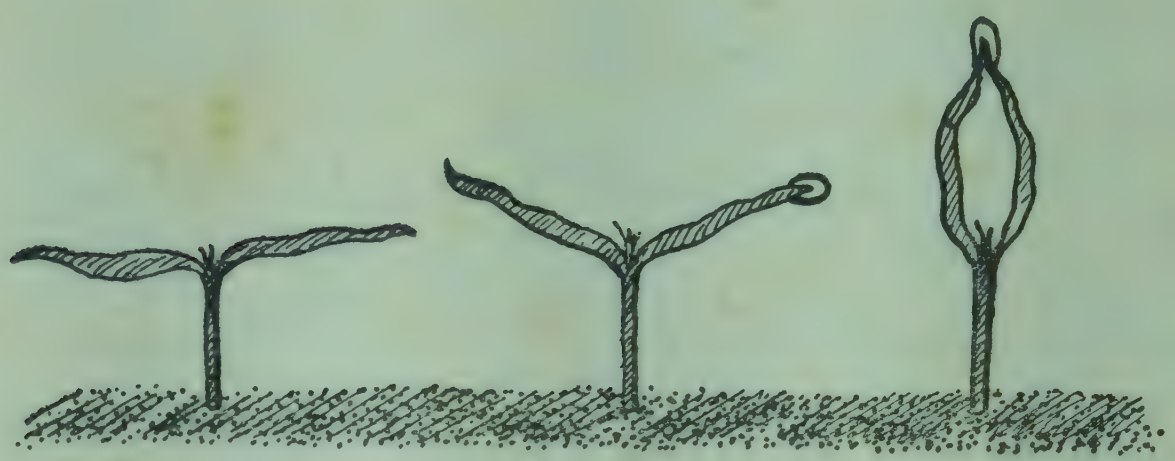


Fig. 10.

Seed Emergence.

For the first two days after the seeds have arched their way through the soil, prop up the glass on one side by sticking the label point downwards into the soil, and resting the glass on this. If coloured glass is used no other shading is necessary. Gradually expose the seedling, and in about five days remove them to the part of the greenhouse that gets the most light. A shelf about 12 or 15 inches from the glass is the best place from them, as there they will get the maximum amount of light, and more air than they would down on the bench.

Watering of Seedlings.

The watering of seedlings is most important, and much damage can be done by overhead watering when done by an unskilled hand. Watering overhead generally

tends to knock the seedlings down, and although they try to straighten themselves up, the seedlings so watered look like sick men In the early part of the year the, less water that is splashed on the leaves the better.

Although not always possible in a small greenhouse, the best way to water seedlings is to hold the boxes in a shallow tank of water so that the water level outside the box comes half an inch lower than the soil on the inside of the box.

Temperature of Water.

Cold water should not be used for watering seedlings, and water should not be drawn direct from a tap or even from a tank in a greenhouse into which rain water is running.

It is surprising to find how hot the water can be used for watering seedlings in pots and boxes, and in fact, may be used as hot as one can bear one's hand in. If this hot water treatment is started, it should be continued until planting out time.

Time for Sowing Tomato Seeds.

The time to sow tomato seeds is almost as big a problem as how to sow them, and is governed by a number of factors, such as the amount of heat available, when the crop is required, the variety it is intended to grow, and also, the method of planting, whether in the ground or in pots, in boxes, or in soil blocks.

Taking the gardening season as commencing in January, seeds may be sown at any period between the first week in January and the last week in April, with the reasonable certainty that ripe fruit will be gathered during the current year. The actual time of sowing will depend on the time that the crop is required, and the amount of heat which can be maintained to get it.

As a rough guide, plants from tomato seed sown on the 8th January will generally commence to fruit during the last week in May or early June in the northern half of England when grown in a temperature which does not fall below 48 degrees at night. Other factors which may influence the length of time between seed sowing and gathering are the methods of training, feeding, and the variety used, and these will be dealt with in later chapters.

3

PREPARATION OF THE SOIL

CONTRARY to general belief the amount of manure or chemicals in the soil for tomatoes is not the most important requirement for a good crop. In fact I would say that the manurial treatment is only of secondary consideration. Important it is true, but not nearly as important as some professional growers believe. What is most important is that the soil available should be well worked, and that any manure or fertilisers should be thoroughly mixed and incorporated with the soil in order to provide a free run for the roots.

Soils vary in texture and quality from garden to garden, so that it is impossible to lay down a hard and fast rule for the treatment of every individual piece of land, or, where boxes are used for tomatoes, a soil mixture for every garden. Generally speaking, tomatoes are not particular as to soil, but they seem to do better on soil which is rather on the heavy side and is referred to as having a bit of body in it. Such soils are more retentive of moisture and are not so prone to dry out during the summer months. On the other hand unless these soils are well worked they tend to crack and the surface becomes hard when full of roots.

In cold wet districts the biggest trouble is that heavy soils are cold, and unless artificially heated by soil heating cables or steam pipes, tend to retard growth during the early part of the year. These soils however may be improved by various devices.

Assuming that the tomatoes are being grown in beds

on the floor of the house, the first requirement is to plan the house with a view to allowing the greatest number of plants to be cultivated without crowding, and to allow of easy access to them for all cultural purposes. These requirements include tying and stringing, staking, spraying, watering and allowing air to circulate freely through the plants. Suitable spaces must also be set aside to act as paths where permanent paths are not a feature of the greenhouse.

Fig. 13. An ideal arrangement for cultivating plants with easy access to them.

It will be seen that the size of the bed or beds will be determined by the floor space available, but unless the plants are widely spaced, no bed should be more than $5\frac{1}{2}$ feet wide. Such a bed will accommodate four rows of plants at eighteen inches apart and six inches in from the edge of the bed. When planting a bed of this size a two foot wide path should be arranged on each side of the main four row bed.

When a new greenhouse is being laid out, it is comparatively easy to arrange the beds in such a way that they do not receive the drainage from the land outside, but this is not nearly so easy in an established greenhouse. The failure of many crops can be attributed to the efforts of the grower to provide ideal conditions for his tomato plants by digging out a lot of the old soil and

filling in the holes so formed with fresh loamy soil. The result is generally that he has provided an excellent drainage sump for his own plot or for that of his neighbours. Actually it is always far better for the soil in the greenhouse bed to be above the level of the soil outside. This will assist the drainage and the water outside will not seep into the greenhouse making the soil waterlogged. The soil will also be better aerated and much warmer, both most important conditions for the well-being of tomato plants.

When a greenhouse has been used for another crop such as lettuces or chrysanthemums all the debris should be removed and all old leaves, roots and pieces of stem should be raked up and cleared out of the greenhouse. On no account should such material be dug into the soil.

The depth of the soil does not matter greatly as long as there is at least nine inches of good friable well worked soil on top. If the subsoil is solid clay it is not always advisable to remove this but to break it up as in bastard trenching, and working in to the bottom spit plenty of compost or half decayed straw or strawy horse manure. After several years of this treatment, this bottom spit will be in excellent condition. If the soil conditions do not lend themselves to this treatment, it may be advisable to insulate the clay from the upper soil by a six to nine inch layer of finely broken brick or clinkers. This in turn being covered by nine or twelve inches of soil, which may either be removed annually or sterilised if required.

Few people have access to the ideal soil in which to plant tomatoes. This would be a rather greasy fibrous loam of medium to heavy texture, which has been cut from a pasture some hundred years old. The loam should be stacked for at least 12 months and then chopped into pieces about the size of walnuts. Such material would

need little in the way of fertilisers or manure, as the fibre and reserve food in the soil would provide practically all the plant food materials required. Unfortunately such soil rarely comes to hand, but that which most readily comes to hand is often far from ideal.

Even where choice is limited, matters are often made worse by confusing grass and grass roots and the weedy growth off neglected gardens or overgrown hen runs with turf. Such material is usually infested with all sorts of pests, which deprived of their natural food of grass roots turn to tomato plants with great relish. Soil taken from the vegetable garden is preferable.

Generally speaking, any soil which normally grows a good crop of vegetables will grow a good crop of tomatoes.

The soil should be taken a spit deep off the whole area of the garden and not dug out of a hole, but first skim off and put to one side the top inch, as this is sure to contain weed seeds.

The requirements of the soil for tomatoes are that it should be retentive of moisture without becoming water logged, and that it should be sufficiently well drained without drying out too quickly. It should not be in such a fine state of division that it consolidates and becomes hard, excluding air and making it difficult for water to penetrate. On the other hand it must not be so porous that water runs straight through it. It must also contain sufficient plant food to carry the plant through in a state of robust health until additional plant forming materials are necessary, as determined by the state of the plant.

This would seem impossible of accomplishment, but as I have said before tomatoes are not too particular, provided the soil in which they are planted allows the roots to run freely in all directions.

Good turf owes much of its merit as a potting medium to he vast number of fibres which it contains, and to its eserves of food left from the decay of grasses. The fibres erve two purposes; they prevent the soil running ogether and consolidating, which is termed keeping the oil open. On decaying, they provide a source of humus nd their former passageways through the soil make little hannels down which air and moisture can percolate.

It should be noted here that fresh fibrous roots from reshly cut turf, are to a certain extent harmful to plant rowth, and this is one of the reasons why turf is always ecommended to be stacked for from 9–12 months before eing used.

As there is rarely any fibre in the soil taken from an rdinary vegetable garden this must be replaced by a omparable or similar substance. Materials which most nearly approximate to the fibre in turf are Peat, Compost, Straw, well rotted manure, and to a lesser degree leather dust or granulated leather.

Opinions and recipes vary from grower to grower as to the most suitable additions which should be made to the soil to provide food making material for the plant. This has considerable justification and is not merely a fad on the part of the grower. Situation, soil, climatic conditions, elevation, geographical position, variety, all play their part in determining what should be added to the soil. Only experience can decide this, but for the beginner who is compelled to use ordinary garden soil of unknown quality, the following can be relied upon to give good results.

To each four bucketsful of soil, add one bucket of well composted material, or one bucket of well rotted horse or farmyard manure, or failing this two-thirds of a bucket of granulated peat.

Peat is one of the last things however, which I would prefer to use for tomato soil, as its continual use tends to build up a high humus content of an acid nature and will in time produce an unbalanced soil.

To each four buckets of soil add one five inch plant pot full of steamed bonemeal.

A third of a bucket of lime rubble or crushed clinker.

Two heaped dessertspoonfuls of Sulphate of Potash, or Muriate of Potash.

These proportions should remain substantially constant whatever the quantity mixed.

Mixing.

All the materials for mixing should be placed on a flat surface which makes it easier for shovelling, but do not make the mistake of getting together one huge heap of soil and then adding the other ingredients to the outside of the heap, as this makes it more difficult to mix in thoroughly.

It is better to take the four buckets of soil, bonemeal etc., and then four more buckets of soil until the required pile has been built up. Like a good cake, the secret of the finished produce is in the mixing, and one or two turnings over is not sufficient to mix it thoroughly. The sides of the heap should be turned to the middle for at least six times until the whole is thoroughly mixed. If possible the mixed soil should be allowed to stand for about ten days and then turned again two or three times before being used. This increases the amount of nitrogen in the soil and assists the soil bacteria to receive more air. They help in turn by making the living soil more healthy and more able to resist any harmful bacteria or disease which may develop later on. Do not expose the soil to heavy rain or mix when in a sloppy condition ; conversely the

oil should not be dust dry. If very dry, water should be dded as the mixing proceeds.

The soil can now be carted into the greenhouse, and sed for making up the beds or for putting in pots and oxes.

Making Up Beds.

Where the beds have been previously used for tomatoes or another crop and the soil has not been removed for hanging, it is sufficient to add the manure or compost at he rate of one bucketful to two square yards of soil. Bonemeal at the rate of two ounces to the square yard, and Sulphate or Muriate or Potash also at two ounces to the square yard, adding half a bucket of lime rubble to two square yards. It is not advisable to scatter this material on the ground before digging as it tends to be turned over by the spade, thus forming a layer about ten inches down. To be most beneficial, all manures and fertilisers should be thoroughly mixed and incorporated with the soil. This is best done by taking out a trench, as in the normal way of digging, having the forward slope at a flattish angle thus :

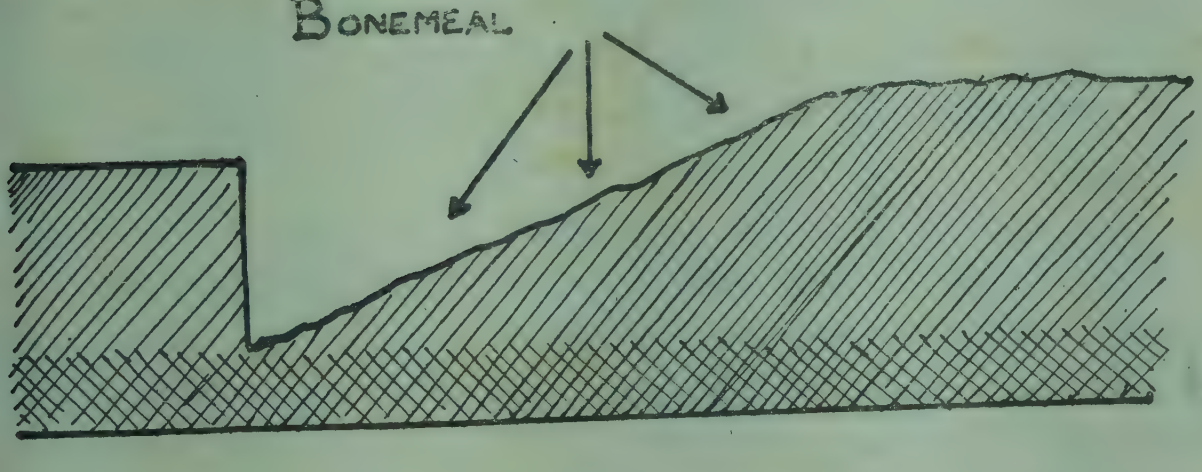


Fig. 14.

Scatter the manure on the soil together with the bone-meal and potash, mixing this in with a fork. Turn over

the next spit and proceed as before. If no lime rubble is available give a dressing of ordinary hydrated lime on the surface, at the rate of a closed handful to the square yard, raking this in before planting.

Boxes.

It is often found more convenient to grow tomato plants in wooden boxes or troughs made by placing boards on edge, or alternatively by placing bricks along the edge of a flat bench. In a professionally built house—one which has permanent benches of iron or concrete and which are normally covered with ashes, chippings or gravel—tomatoes may be grown to perfection by utilising this covering. Such benches are usually of a width which makes it more convenient to grow two rows of tomato plants close up to the glass and training them up the roof glass.

The ashes or gravel can be scraped forward, and two boards placed on edge about 18 inches apart over the scraped surface of the bench. These can be kept in position by battens nailed across the top edge of the boards, the bottom being formed by the surface of the bench. Chopped turf or other coarse material should be placed in the bottom and the mixed soil placed in the trough.

The gravel or ashes may then be levelled out in front of the trough and smaller plants such as ferns may be stood on this during the summer months. The advantage is that the roots of the tomato plants will travel freely through the gravel or ashes in search of moisture, these roots may be fed when required by scattering fertiliser lightly on the ashes. This increased rooting area will produce heavy crops and I have often obtained 25 lbs. per plant when growing them in this manner. Another

vantage is that the roots are much warmer, rarely dry t, and never become waterlogged, whilst air freely netrates through the ashes.

ots.

The same soil as recommended above for boxes may be ed for pot work. The most satisfactory pots for growing matoes are those which measure about 10 inches across e top. These should be well drained by placing pieces broken pot in the bottom and covering them to a depth about three inches with chopped turf or other lumpy aterial, filling up to about two thirds of their depth with epared soil and in this way leaving room for a top essing.

REPARING THE SOIL IN THE BEDS USING STRAW.

Of late years this method has become extremely opular and having used it for over 30 years, the writer n vouch for its efficacy.

In case the reader is reluctant to try this method I uote from one of the many letters I have received on this bject :—

" I sincerely thank you for your advice on the cultiv- ion of tomatoes as given over the wireless early in the ason, and am pleased to state that after following your structions I have amazed my friends and myself with the sults.

" I very much doubted your statement made over the r that 10–12 lbs. per plant could be obtained, but I see at if all goes well I should surpass even this weight er plant."

As far as my own experience goes, this method was a rect result of the practice carried out on a nursery at hich I was employed as a boy, namely that of mulching e growing crop with old straw thatch from stacks.

This straw after serving as a mulch during the summer was dug in after the crop was taken in, very often in a crispy dry state, and we noted that in the houses where this practice was adopted not one plant ever suffered from root or soil borne diseases. This eventually led to the digging in of wheat straw at the beginning of each season.

It was not until 1946 that I noted in the 32nd annual report of the Experimental Research Station at Turners Hill, Cheshunt, Herts, an account of the work done by Erna Grossbard on the control of plant diseases by microbial antagonism. Briefly, this means that certain substances and notably wheat straw, produces a substance called " Clavatin " which works in the soil much in the same way as Penicillin does in the human body. Other materials are being tried out and the pulp left after the extraction from sugar beet gives encouraging results.

Trials in 1948 showed an increase of 27% in crop yield, amounting to 11 tons per acre.

So although I had been growing tomatoes successfully for many years by using this method, I had no idea of the scientific reasons for my immunity from diseases. Further more, on no occasion has it been found necessary to sterilise the soil in which my tomatoes have been grown.

It should be made clear however, that I have no knowledge as to how this method would act on soil which has already been infected by diseases, and using it as a substitute for sterilising in the accepted way. Provided the soil is clean and free from disease at the beginning, there appears to be no reason why a healthy condition should not be maintained.

Commercial field trials conducted by Vitax Fertilisers Ormskirk 1950 have produced amazing results based on these observations.

oss of Nitrogen.

The digging in of straw into the soil appears to have a epressing action on the little bacteria which helps to rovide the plants with nitrogen, but this corrects itself hen straw is used continually over a period, and by the ddition of substances such as Bonemeal and Hoof and Horn, which help to make up for this loss of what may be alled natural Nitrogen.

Method.

It is essential that soil prepared in this way is made eady sufficiently early for chemical reaction to take place n the soil, and it has been my practice to prepare the beds or tomatoes, at the same time as the seed is sown. This s generally about the first week in January. Soil pre- pared by using dry straw only a week or two before the plants are planted out often gives disappointing results, as the plants and the warmer conditions combined with he better aerated soil seem to deprive the soil of the necessary moisture which is so essential to the good growth and development of all young plants.

Various methods have been recommended for getting he straw into the soil, but for the ordinary grower I hink the following is the easiest way.

Take out a trench at one end of the bed or box in such a way that the trench has a long sloping forward face.

On this face lay a bunch of straw which has been cut nto handy lengths of about nine inches long. The straw nay be cut up by any convenient means, either with a pair of shears or chopped up on a wood block with a chopper.

The quantity of straw required for one running foot of rench is as much as can be grasped in one hand with the ingers not quite tightly closed.

The straw should be placed in the trench obliquely with the top ends of straw about two inches below the surface level. It is placed in this way for two reasons. Firstly, because the forward slope of a trench is generally about 14 inches long, that is, from the bottom of the trench to the top of the soil. By placing the straw obliquely the top ends of the straw are nicely covered by the soil and they do not stick out like sore fingers and become a nuisance during cultural operations, and is not in the way if another crop is grown before or with the tomatoes.

Another reason for inclining the straw is that any water applied to the surface will be prevented from running straight down into the ground without wetting the top six inches. Straw will not decay readily in dry soil and the plants themselves will not receive an even distribution, or sufficiency of water if the straw is put down like a thatch.

It will be readily seen from the diagrams how the layers of straw are arranged in the soil, and this method should be adopted as nearly as possible.

After the straw has been placed in the first trench, sprinkle Bonemeal and Sulphate of Potash on it at the rate of one closed handful per running yard of trench. Thus in each trench there should be, Straw at the rate of ONE HANDFUL PER RUNNING FOOT OF TRENCH, and Bonemeal and Sulphate of Potash at the rate of ONE HANDFUL PER RUNNING YARD.

Dig over the next spit as in ordinary digging, and repeat the operation of placing the straw and fertilisers as advised.

In practice I find that the application of Bonemeal to the soil adds that half per cent or so of Nitrogen which is lost by adding the straw, and that after the first year, the improved mechanical condition of the soil takes care of

the slight loss of Nitrogen, plus of course, any residue of Nitrogenous fertilisers which may be left in the soil after the crop has been taken.

It would not be true to say that the soil receives no manure at all when the straw method is employed, as it is a regular practice to give a mulch of half rotted manure about the time that the fruit from the FIRST truss is being gathered. The remains of this are scraped into the bottom of the trench when the soil is being dug over at the end of the season, or if the tomato crop is followed by Lettuces or Chrysanthemums, when the soil is turned over for these.

LIME.

I prefer lime for tomatoes to be in the form of old mortar rubble, and the results are worth the effort to obtain it.

The way that lime is applied depends on whether a crop of lettuces is taken before or during planting.

If only tomatoes are being grown, lime rubble at the rate of about four handsful to the square yard is applied to the surface of the soil after digging and forked in to a depth of about two inches. This can be done without disturbing the straw. Lime always tends to sink in the soil.

If crops like Radishes or Lettuces are grown in the soil previous to planting tomatoes, hydrated lime should be scattered on the soil at the rate of ONE good handful to the square yard, and only lightly RAKED in. This not only helps to prevent lettuces from "Damping off" but helps to prevent the transmission of disease spores to the main tomato crop.

USING STRAW WITH NEW SOIL.

If the soil in the beds or boxes is being replaced with

new soil, whether virgin turf or soil from the garden, the method of applying the straw is substantially the same.

Arrange the first barrow load or bucketful of soil in the same way as the dug soil would lay when turned over (Fig. 15) add the straw and fertiliser as previously advised.

If for any reason the upper soil of the excavated bed has been walked on, do not leave this tramped down to form a hard pan, but prick this up with a fork before tipping the next load of soil, on it.

Fig. 15.

PREPARING THE SOIL FOR PLANTING.

As previously stated, if the mechanical condition of the soil for tomatoes is of far more importance than the chemical content, then it follows that the water content of the soil is also of great importance.

Unfortunately no hard and fast rule can be laid down as to how much water should be applied after the soil has been prepared, as the depth of the soil and of course, its nature, is bound to vary from garden to garden. As a rough guide however, light soils will need a really good soaking after preparation, and heavy soils but little. Again, soil which has been carried into the greenhouse will need more water than that which has merely been turned over, for the reason that the top layer of soil, is

in more natural and intimate contact with the soil water in the subsoil than that which has just been placed on it. Similarly if an insulating layer such as turf squares be placed between the top layer and the subsoil, the top layer will tend to dry out more quickly because of lack of contact.

Any watering should be done at least a fortnight before planting takes place, so that walking on the soil will not paddle it down hard.

Tomatoes require a firm consolidated soil, but this does not mean one which has been rammed down to such an extent that all the air has been squeezed out and the soil set like concrete.

On ordinary soil of reasonable texture such as would be found in a normal garden, a light treading over once is sufficient. My practice is to prepare the soil, tread it over once, lightly prick the foot marks out with a digging fork and soak the soil thoroughly. This is done at least SIX weeks before planting, and the ground is not touched again until a few days before planting, when the surface is again pricked up and roughly raked over.

The soil should now be in such a state that when a handful is picked up and compressed by closing the hand, the soil will stick together. If this lump is then held at waist height and dropped on to the toe of the boot it should split into two or more pieces. The number of pieces it breaks into will serve as a guide to the wetness or dryness of the soil. If it breaks easily into a number of pieces, then it is on the dry side, if only into two or three biggish pieces then it is about right for planting. This, by the way, can be taken as a guide for any planting.

LIBRARY

4

SOIL STERILISATION

IT should be made quite clear at the beginning that although the term "sterilisation" is generally used to describe the operation this is not strictly true, as a sterile soil is a dead or inert one, in which nothing would grow until the life-giving bacteria had re-established themselves.

The term "soil sterilisation" has come to mean the partial sterilisation of soils by a number of means, but whether these can be practised with advantage by the small grower is entirely a matter for his own discretion.

Lest I should be misunderstood, let me hasten to say that I do not minimise the benefits of soil sterilisation, but very often the entire removal of old soil and its replacement by new clean soil is more practicable than sterilisation.

In many cases the purchase of sterilised soil is a better proposition than attempting to sterilise one's own for the following reasons.

Sterilisation by steam is out of the question for the small man and current is not always available for an electric steriliser, whilst chemicals to be effective require large quantities of water, the effectiveness of all chemical sterilising agents depending on their ability to reach every particle of soil.

When to Sterilise.

Unless the crop of the previous year is poor and the plants showed by their loss of vigour that something was

seriously wrong with the soil conditions, it may not be worthwhile to sterilise the soil in the greenhouse, relying on a topping of new soil to liven up the old until the entire soil has to be changed.

Where a large open sided but covered shed is available, soil may be sterilised in this, but as here again the soil must be transported from the greenhouse and back again, new soil may as well be used.

When it is not practicable to sterilise the whole of the soil in which the tomatoes are to be grown, it may be desirable or even necessary to sterilise the soil in which the young plants are potted.

For this purpose small quantities of soil may be treated chemically or by a rather crude but effective method as follows :—

Obtain an old wash boiler, dustbin, oil drum or similar utensil and see that this is quite clean.

Pass the soil to be sterilised through a quarter-inch sieve, or if required for potting or seed sowing the whole may be mixed ready before sterilising.

See that the mixture is fairly damp and then, using an old shovel—do not use a good spade or the temper may be affected by the heat, hold a half shovelful at a time over a gas ring, greenhouse fire, or even a fire in a bucket.

Stir the soil with a stick while over the fire, until the whole mixture is just too hot to hold comfortably.

Tip this into the bin and cover with a lid or several old sacks. Repeat this until the bin is full or you have as much soil as is needed.

Keep the soil well covered up, and allow it to stand until cool. Although crude this method is very effective for small quantities of soil or potting compost, and the merit is that it can be done anywhere and under almost any condition without expense

Sterilisation by Exposure.

Although this must not be regarded as sterilisation in the strictest sense of the word, it is undeniable that soil taken from greenhouse beds does materially benefit by exposure to frost and winter rains.

The soil should be removed from the greenhouse and wheeled on to a vacant plot of land and tipped in long narrow ridge shaped heaps, which should rise as sharply as possible.

The narrow ridges are more easily frozen through, and furthermore the sharper slopes will throw off the heavy rains which would tend to make loose soil soggy and sloppy to use.

Wheel into the greenhouse again at least a month before needed for planting and top with fresh soil.

Liquid Chemical Soil Sterilising Agents.

There are several of these but perhaps the two chemicals most widely used are Formalin generally referred to as Formaldehyde and Cresylic Acid.

Outside purely horticultural circles this latter is perhaps not so well known, but has been in use for many years.

These chemicals suffer from the following disabilities which do not make for popularity amongst the class of grower for which this book is intended.

Formaldehyde fumes will destroy for several weeks any plant life in the greenhouse in which it is used—depending on the concentration.

It is unpleasant to use in a confined space, and is not very effective unless the whole of the soil is thoroughly wetted right through its bulk.

Unless the soil is ærated, well turned and allowed to stand for at least three weeks before use, it is fatal to put plants into the soil, or even bring the plants near it.

The fumes from Cresylic acid are less harmful to plants than Formaldehyde, but great care should be taken not to expose the bare hands to even a weak solution. Rubber gloves should be worn and the liquid should be kept off boots and clothes, and if your eye itches, get someone else to rub it.

If you are prepared now to sterilise your soil, proceed as follows :

Cresylic or Carbolic Acid.

Potting soil. Make a heap of soil outside or under an open shed, and water it with a solution diluted to not less than one part to 50 parts of water and thoroughly saturate the soil. Better still, put the soil into a tank with a mixture of 2½ fluid ounces to three gallons of water and allow to stand for 24 hours. This is sufficient for a cwt. of soil

Allow to stand for six weeks before using.

As acid is very rapidly absorbed by the soil, it is a waste of time to pour the acid on the soil and try to wash it in with a hose pipe. The top three inches or so of soil will have absorbed the acid and only this soil will benefit from the treatment.

Sterilising the Tomato Bed. The most effective way of sterilising the soil is to dig it over thoroughly, and mix one gallon of acid with 150 gallons of water and pour this on to nine square yards of soil as quickly as possible. Water is only a carrier for the acid, and unless the soil has reached saturation point anything less means incomplete treatment and a lot of trouble for nothing.

One gallon in 50 gallons of water as usually recommended is not sufficient to soak soil to a greater depth than about four inches, so as much water as possible should be used.

Do not plant in chemically treated soil for at least three weeks.

Wear gloves and protective clothing when using acid.

FORMALDEHYDE.

Use this by adding 49 parts of water to one part commercial grade Formaldehyde to soak the soil.

All plants must be removed from the greenhouse and doors and ventilators should be opened before it is attempted to sterilise the old soil without taking it outside.

The fumes from this liquid are very strong and the ordinary civilian gas respirator gives some protection from these.

To reduce fumes in the greenhouse to a minimum and to obtain the greatest benefit proceed as follows :—

Depending on the size of the bed, dig over deeply a portion of the ground in the centre of the greenhouse and soak this with the solution. Quickly place a layer of soil from the surrounding area on top of this, soak this layer and continue this process until all the soil to a spade depth has been placed on one or more heaps. These heaps of saturated soil will look like cone shaped potato clamps.

Cover these with damp sacks, waterproof sheeting or other similar material to keep the fumes in.

Leave the ventilators open and do not introduce any form of plant life for at least three weeks and do not use the soil for at least six.

After three weeks in the heaps, spread out again to its original place. If there is any doubt about the soil being safe to use, water it with a solution of Permanganate of Potash which will neutralise the remaining traces of Formaldehyde. It should be stressed that Formaldehyde

s more of a fungicide than an insecticide, so do not be urprised if wireworms survive even this treatment.

Keep a sharp look out for them as the soil is turned, and make sure that they are very dead by cutting them in halves.

Powder Sterilising Agents.

Some of these are very effective, and the best of them rank with liquid chemical sterilising agents, they are however much easier to apply to the soil.

Dig these into the soil carefully scattering the powder so that the powder becomes intimately mixed with the soil.

As many of these rely on the fumes they give off, the makers instructions should be carefully followed, so that no ill effect is suffered by any other occupants of the greenhouse.

5

CARE OF THE SEEDLINGS

Pricking Off and Potting Up Seedlings.

TOMATO seedlings should be transferred from the boxes in which they were sown, to other boxes or to small pots as soon as they are big enough to handle. This is generally when they are about an inch high, and the seed leaves or single bladed cotyledons are as long as the stem. If this job is left too long the plants get too big and take much longer to get over the check of transplanting, but if properly done, the small seedling should not feel the transference from box to pot at all. In fact, if the transplanted seedlings are compared after a few days with those left in the seed box, the transplanted ones should be nearly twice as big as those which have not been moved.

Soil for Potting.

Soil for potting should always be prepared a few days before it is required for use, and should it have to be brought in from outside, then it needs to be placed in the same temperature or actually in the greenhouse itself in which the seedlings are grown, as it takes at least twelve hours for a bucket of soil to be warmed throughout its bulk. The soil should be kept in the greenhouse for at least 48 hours before transplanting to be on the safe side. If this is impracticable, the soil can be warmed by heating one or more bricks and placing these in the heap for about two hours, after which the whole heap should be turned and thoroughly mixed.

As the whole secret of tomato growing is to grow the plants through every stage without a check, special care must be taken to get the soil into just the right condition for good root action. It must contain as near as can be assessed the correct amount of food to sustain the plants until they are put into their final quarters. At the same time, it should not contain any substance which will make or induce rank growth, or on the other hand anything to check development. The soil should be fine enough to allow the roots to penetrate freely into all parts, and sufficiently coarse not to set hard like a block of cement.

When soil is taken from the garden for this purpose it often settles down very hard after it has been watered once or twice, due to the fact that there is little or no fibre in it to keep it open. This deficiency must be made up by adding sufficient granulated peat or leaf mould which has been rubbed through a quarter inch riddle. In addition, some coarse gritty sand, or failing this finely crushed brick, crushed clinkers, or old lime rubble will assist in keeping the soil open. The actual amount of peat, sand and lime rubble which is added to the bulk of the soil, must depend on the type and nature of the soil as it will be obvious that more sand and gritty material will be needed if the soil is of a heavy close texture than if the soil is of a light sandy nature.

Ordinary soil from the vegetable garden can be used very successfully for potting if no other source is available, and the following formula is given for general guidance. To one bucket of ordinary garden soil which has been passed through a quarter inch riddle, add :—

A 3 inch potful of old mortar rubble, or an eggcupful of ground chalk.

An eggcupful of bonemeal, and the same quantity of Superphosphate of Lime.

One third of a bucketful of granulated peat, and sufficient sand or brick dust to give the soil a gritty feeling when rubbed through the hands. The amount of sand added of course, must depend on the texture of the bulk of the soil.

Mix the whole together thoroughly on a flat surface, and do not attempt to mix it in a bucket with a stick like a mess of poultry food. Any quantity may be mixed at the same time, but the proportions should remain approximately the same.

For the benefit of those who have access to good turfy loam the formula advocated by the John Innes Institute may be followed with excellent results. In any case, whatever the mixture, it should be turned over three or four times and finally mixed by hand.

This is the only way that a true estimation of the correct mixing of soil can be arrived at, as the mere mixing of soil with a spade reveals little to the mixer, but intimate contact of the soil with the hands means everything. It is perfectly true that very large quantities of soil cannot be mixed with the hands, but even on large nurseries where tons of soil are mixed, the charge hand will check the soil by feeling it and even smelling it. If you get the opportunity, watch an old gardener pass a mixing of potting soil through his hands, and note the loving care with which he does it. Like a good cake, it's all in the mixing.

As previously stated, any quantity of soil may be mixed using the same proportions as given, but the amount of fertiliser should not be increased as this may do more harm than good. In this case enough is better than a feast. The reason for adding both bonemeal and Superphosphate is because they both contain phosphates, which are needed for the young plants at different stages

of their growth. A large proportion of the phosphates in the Superphosphates are available to the young plants straight away, but some do not dissolve readily in water, and so the small plants cannot make use of them until another change takes place.

Most soils are short of phosphates, so the addition of this ingredient is very important as it assists the formation of the roots, which is essential at this stage in the development of the plant. Bonemeal also contains phosphates but as the bulk of this has to be released by the actual decay of the small particles of bone, the benefit of this may not felt for more than a month after its application. In some cases the plant may be actually transferred to its final quarters before all this becomes available, but it will have this reserve of food close at hand to draw upon. In addition bonemeal contains a small quantity of nitrogen which is quickly available, and as this substance helps to make roots as well as leaves the reason for adding this will be readily appreciated. This small amount of nitrogen however is not sufficient to stimulate the plant into rapid growth, but will help it to continue to grow steadily so that the rate of growth above the soil is balanced by the root action below. The roots sending up the raw materials to the leaves, which convert it into suitable food for the plant, and is in turn re-distributed throughout the entire plant, even back to the very roots which absorb the raw materials.

The Use of Boxes or Pots.

Whether boxes or pots are used in which to prick off small plants, is entirely a matter for the grower to decide, as tests over many years have failed to show any appreciable difference in the quality of the plant and

weight of crop, between box or pot grown plants, provided that care is taken of the plants between boxing and planting out.

Generally speaking it is at planting out time that box grown plants are liable to suffer most from careless handling, owing to the mutilation of the roots.

Both methods have their advantages, and the box method may appeal more to the man who is away from home during the day and is unable to give daily attention to his plants. Plants in boxes are less liable to suffer from rapid changes of temperature, which may be caused through strong bursts of sunshine during the early part of the year. At this time of the year, the temperature may rise quickly and drop as rapidly, and the extra volume of soil in the boxes as compared with a small pot tends to conserve both the heat and moisture.

Small pots are much more liable to dry out quickly than boxes and when this happens it is extremely difficult to get them moist again, especially when this has to be done at night by the aid of a hurricane lamp. This drying out is one of the worst things that can happen to any young plant and especially with tomatoes, as although they may appear to recover and take no harm, the effect will be felt and seen later on. On the other hand, the transplantation of the young plants from pots into their final fruiting quarters, may be done with little check to growth, as the roots are not so liable to damage and disturbance.

When own plants are raised from seed and potted up or pricked off into boxes, root disturbance may be reduced to a minimum by correct timing of sowing. Generally speaking the longer the young plants are expected to remain in the boxes the farther they should be planted apart. Most plants bought in from nurserymen are

planted far too closely together and as the soil in the boxes allows a free lateral or sideways root run, the roots may run the full length of the box, whereas those in a pot soon come in contact with the sides and start to curl round.

Pricking Off.

When the time comes for the actual pricking off, the advantages of spacing the seeds as previously described will soon be apparent, as it will be found that every individual plantlet can be removed without disturbing its roots, or those of its neighbours. This operation is best done in the greenhouse in which the plants are growing. It is much pleasanter for the operators, and what is really of more importance, the plants do not receive any check to growth by taking the seed pan or box from one building to another. It is an actual fact that the carrying of a box of seedlings a few yards from a greenhouse to shed on a cold day may check the growth for three weeks.

If boxes are used, these should be filled with the prepared soil and carried into the greenhouse. Should the soil be dry, this should be watered a day or two beforehand so that it is not puddly at the time of planting. It should be in such a state that no watering is necessary for at least 12 hours after planting. Most other plants appreciate a watering immediately after planting, but tomatoes seem to do better if they are allowed about 12 hours in which to settle down before any watering takes place. The same type of box as was used for seedlings is recommended for pricking off and the same precautions should be observed, that is, rough material at the bottom of the box for drainage and the soil well packed down with the fingers at the corners. The best and simplest tool for transplanting is an ordinary 5 inch wood label, but if this is not a brand new one, precautions should be taken

to sterilise it before use. This is a little point, but if an old label that has been picked off the floor or taken out of an old box be used, several types of disease may be transferred to the fresh soil.

Place the box full of soil on a bench at a convenient height in front of you, with the broad side of the box facing you, and start planting on the far side of the box commencing about an inch and a half from the edge. It is not everybody that can prick off seedlings successfully and the following simple hints may be helpful.

Stick the label into the soil for about an inch of its length and draw it towards you, this will make a small hole in much the same way as would a trowel. Then insert the point of the label in the seed box or pot containing the plants about a quarter of an inch from the base of a seedling. Push the label down about an inch and by inclining the top of the label slightly, it will lever the seedling out of the soil without disturbing the soil from its root. Steady the seedling if necessary with the other hand by holding it by one seed leaf or cotyledon. Convey the small plant on the point of the label to the little hole which has already been dug in the box or soil block to receive it and lower carefully in. Make the plant firm and comfortable in its new home by pressing the soil back with the point of the label on one side of it and with the fingers on the other. The reason why it is inadvisable to handle the seedling by the stem, is that the slightest touch may damage the delicate stem of the plant and that stem will have to remain with the plant all its life, whereas the cotyledon will die off in any case.

When firming the soil around the young seedling do not press directly inwards, but inwards and downwards, otherwise the gritty particles of sand will be squeezed into the soft and tender stem making a wound which can

easily admit some harmful disease. One single grain of sand pressed into the stem can do an incalculable amount of damage.

Potting Up.

If the seedlings are to be potted up instead of being pricked off into boxes, it is better to use three inch pots for this job. The writer has used various types and sizes for this initial potting but finds that the wide based three inch pots are to be preferred. If obtainable, coarse cocoanut fibre instead of broken pot or crocks as they're called, is better for draining. A wisp of this is placed in the bottom of the pot and the soil filled in on top of it. The advantage is that it is not necessary to disturb the roots by removing this material when planting in their permanent quarters.

Some growers make a practice of using turf roots for this purpose, but where this material is not obtainable, partially rotted straw answers very well. Lumps of broken pots occupy too much space in a small pot, and root tips may be damaged when these crocks are removed, and besides, crocks can never hold just that little reserve of moisture which turf or straw does. There is an added danger too, that dirty crocks may be used, thus introducing disease to an otherwise clean plant.

The main thing is that whatever material is used, it must be some substance through which the water can pass freely out of the hole in the bottom of the pot, and at the same time keep the soil from washing through as well. The pots should be placed ready to hand on the potting bench, but never stand pots up on end when they are inside one another, or sooner or later they are sure to topple over and break. Lay them down with the open end towards you in rows for convenience of handling.

Have the heap of mixed soil in front of you, pots on your left hand side, with the seed pan or box handy at your right hand. Of course if you're left handed place them to suit yourself.

I find that the best way of pricking off into pots is to place the drainage material in the bottom of the pot, and then to fill the pot with soil, piling the soil up loosely as high as it will go, something like an ice cream cornet. Then push your forefinger down the centre of the soil. This makes a hole and gently firms the soil in the pot at the same time without making it too hard.

Lift the seedling with a clean label and transfer it to the pot with the soil attached to the seedling, place it on the edge of the hole and drop it in. Firm gently with the fingers of both hands again taking care not to damage the stem.

Tap the bottom of the pot lightly on the bench to complete the job. This evens out the finger marks in the soil and consolidates the whole lot.

The little plant should now be firmly planted in the centre of the pot, with the cotyledon about a quarter of an inch from the surface of the soil, and the surface of the soil itself should be about an half an inch below the level of the top of the pot.

It will be seen from the foregoing description that the seedling has been buried in the soil about half to three quarters of its length, and by so doing a sturdier plant is obtained, as the buried portion of the stem will send out additional roots. Another advantage is that the little plant will not be top heavy and topple over when it is watered. This often happens if only the roots are buried.

When all the batch has been potted up do not put them straight on to a shelf close up to the glass, but leave them on the bench for a day or two out of the bright light.

shading is easier to arrange if necessary and it may be seen at a glance whether there are any failures, or whether any of them are being nipped off by woodlice.

The soil should be sufficiently damp so that no watering is necessary for at least twelve hours after potting, and even after this time individual watering should be practised, rather than indiscriminate overhead watering through a rose. All watering for some considerable time should be done with aired water to which has been added sufficient Permanganate of Potash to make the water a deep rose pink. Water can be aired by placing a bucketful for twelve hours in the same temperature as that in which the plants are growing.

Watering Seedlings.

Water with a small can using an extension on the spout, to reduce the force of the stream of water from the can, holding the can thus as in Fig. 11, instead of as in Fig. 12.

Direct the water around the edges of the pot until the space between the top of the soil and the top of the pot is full.

In about three days place the pots in full light on a shelf about a foot from the glass. If they are placed closer than this they can easily be killed or severely damaged by a sudden drop in temperature. In the early part of the year during January, February and March, every effort should be made to maintain a temperature of about 55 degrees. If this is beyond the capacity of the heating apparatus it would be better to sow later. Steady growing without a check is essential to tomato plants at all stages of growth.

Planting in Soil Blocks.

If soil blocks are used instead of pots, place the roots of

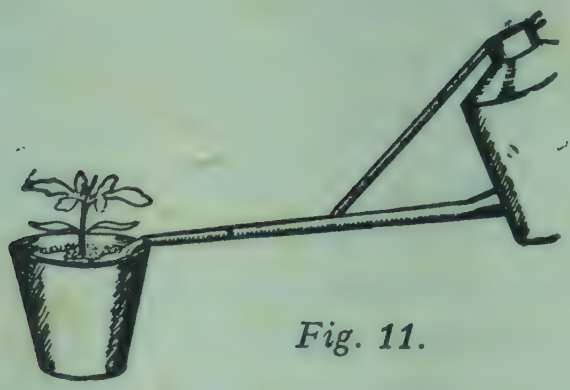


Fig. 11.

The right and the wrong way to water seedlings.

Fig. 12.

the seedlings in the hole in the soil block, and fill in with mixture of equal parts finely sifted sand, peat and soil.

VENTILATION.

On all favourable occasions tomato plants should receive the maximum amount of fresh air, but fresh air does not mean draught. In small greenhouses the constant opening and shutting of a door will more than supply the necessary change of air. More will be said about this important subject of ventilation later.

VARIETIES.

Where more than one variety is being raised they should be rigidly separated, especially if they are being offered for sale. This can easily be done by placing a bamboo cane between the batches of potted up plants and

putting a label at each end of the batch. The two labelled pots should be the last to be removed when the batch is broken up for sale or planting.

Subsequent Cultivation.

From potting up to planting out in their final quarters, the plants should never be allowed to get dry. Wherever possible individual watering should be practised as it is unlikely that all the plants will require watering at the same time. Take care too that they are not exposed to a draught and if there is any danger of this, sheets of glass should be propped up in a position to deflect any cold streams of air.

The now rapidly growing plant should be kept free from weeds, and at least once during this period the surface of the soil should be stirred lightly with the point of a label. Keep a look out for any signs of greenfly as these pests not only extract the juices from the leaves and young growths, but they transmit certain virus diseases which may show themselves at a later date.

It may be mentioned here that it is a curious fact, that although greenfly will attack tomato plants in their young state, but if the same family of greenfly is allowed to remain on the plant until it becomes half grown, they appear to be poisoned by the sap from the plant on which they previously fed and thrived.

Feeding Young Plants.

Provided that the soil in which they are potted has been properly prepared, there should be no need to provide additional nourishment. If however the plants tend to take on a starved look or receive a severe check through being chilled, give them an occasional weak dose of Superphosphate of Lime at the rate of one teaspoonful to one gallon water. Do not use a nitrogenous substance,

phosphates will assist root action without unduly developing leaf and making the plant soft and sappy.

Rogues.

These are known under various names in different parts of the country :—e.g., Rogues, Jacks, Bastards, Feather legged 'uns and so on, but they have the same characteristics and must be ruthlessly weeded out at potting time, as such plants will never produce a crop.

In the early stages they may be easily identified by :—

A. Feathery nature of the foliage.

B. By having five parts to the compound leaf, instead of the usual three.

C. The leaves are much closer together on the stem.

Later these plants will show trusses much sooner than normal plants.

At the first fruit setting stage the appearance of the plants may become almost normal, but few fruits will set and then generally only one on each truss with the trusses very close together.

Note

Examine all plants carefully when buying and refuse plants that are suspect.

It is of interest to note too that seed saved from the fruit off bottom trusses gives a higher proportion of rogues than seed from fruits off second and third trusses.

6

PLANTING, TYING, STAKING AND TRAINING

IT is safe to say that the treatment which the young of anything receives, determines the adult. This is particularly true of plants, and especially of tomato plants, because no amount of good after treatment will make amends for neglect during the vital period from germination to planting.

The plants themselves should have grown steadily without check, or conversely without being forced in any way.

The stems should be firm without being woody, well developed without being sappy, dark green without being blue, and at planting time, should still retain the first seed leaves (cotyledon).

The presence of these seed leaves are sufficient indication that the plant has received no check to its growth, as even one day's neglect will cause these to fall off. There is one thing certain, no unscrupulous nurseryman can put these on again. Perhaps if the buying public refused to accept any plants for planting out without cotyledons, the standard of plants offered would be raised out of all recognition.

Opinions differ as to the stage at which tomato plants should have arrived at before being planted out, but in my opinion that vexed loss of the bottom truss can be traced to plants being too well advanced before being planted.

The pots should be well filled with roots, and have reached that stage when a move is essential. This is

when the roots have reached the side of the pots, but have not yet started going round and round in a fruitless search for food. Box grown plants are more difficult to assess, but great care should be taken to see that roots are not damaged unnecessarily.

Before planting, the pots should receive a really good watering, as, if the ball of soil is dry at planting, it may be weeks before it becomes wet again, and the roots inside the ball are useless to the plant.

All weeds, and any yellowing leaves should be removed as the plants still in the pots are laid out near the stations they will eventually occupy. Such leaves and weeds of course, should NOT be thrown down on the ground, but placed in a tin or box kept for that purpose.

Planting.

The beds or boxes should have been previously measured up so that each plant is at least 18 inches from its nearest neighbour. For plants with strong foliage, notably of Ailsa Craig strains, 20 inches is not too much. Nothing is gained, and much lost both in health and crop weight, if the plants are placed too closely together.

Planting is best done with a trowel, or if a large number are to be planted, with a planting tool as illustrated. This reduces time of planting by more than half.

For the sake of neatness, and to ensure that the correct distance is maintained, a garden line should be used, as few people are sufficiently expert to plant a number of plants in a row without it looking like a dog's hind leg.

A hole should be taken out deep enough and wide enough to allow the plant to fit comfortably into the hole without breaking down the sides of the hole, or the ball of soil. If a line is used, the hole should be taken partly under it, so that the stem of the plant fits closely

p to the line when in position. The tendency is to plant bout two inches away from the line, so that the value of he line is lost. I mention this in case this should catch he eye of young gardeners, who may be inclined to think hat anything will do. Habits ormed young will remain.

After the hole has been nade, stick the trowel into he ground, pick up the pot, pen the fingers of the left nand to receive the stem of he plant between them.

Turn the pot over, and tap he edge of the pot smartly on the handle of the trowel, and the ball should come cleanly away from the side of the pot. Pot bound plants will take more coaxing to come out of the pot. Any crocks or hard drainage material should be carefully removed from the bottom, and the plant placed carefully in the prepared hole. Lumps of turf, unsifted soil, or fibre which may have been used for drainage may be left in, as in most cases the roots will have already penetrated these, and the roots will be damaged if an attempt is made to remove them.

Fig. 16.

The plant should be buried about an inch or an inch and a half lower than it was in the pot. In other words, the top of the ball of soil should be that much below the surface.

Fill in the soil, using trowel and fingers, firming the soil round the plant during the whole of the operation.

If a planting tool is used, no soil need be replaced, as

the ball of soil will fill in the hole, and a slight inward and downward pressure is all that is required. When planting is done on a large scale, this firming can be done with the feet as the work proceeds.

If the soil is in a properly moist condition, no watering should be necessary for several weeks after planting, but in the case of planting on raised benches or in boxes or pots, some water may have to be given 24 to 48 hours after planting.

Watering after Planting.

Many absurd fallacies have sprung up, and unfortunately have gained credence about watering after planting. The time of watering must of course, be guided by common sense. If the weather is hot, and the soil is shallow as on a bench, then daily watering may be necessary. On the other hand, when planting is done in a bed with a high water content, it may not be necessary to water for several months after planting.

It is essential for the plants however, that no check to growth should be caused by lack of water. Different conditions—different methods.

Tying and Training.

The method of training and tying up tomato plants will generally be dicated by the position in which they are grown, but various methods will be described to suit different conditions.

Beds.

Tomatoes are usually grown on a single stem, in which case all side shoots—growths, as distinct from flower trusses, which appear in the junction of leaf and stem, should be removed as they appear. When grown in this way, the plants lend themselves to :—(*a*) tying to a

bamboo cane or stake, (*b*) training up suitable strings. In either case, it is necessary that overhead wires be stretched directly over the rows of plants in the ground. These should be adequately supported at intervals by other wires, angle iron or wood beams, for nothing is more heartbreaking than to come some fine morning to find the whole crop lying on the floor.

At the same time care should be taken to see that the wires are not stretched too tightly when first put up. As metals are affected by changes of temperature, the contraction of a long length of wire will either snap it and let the plants down, or worse still, it may pull the end clean out of the greenhouse—I have seen this happen on more than one occasion.

The wires are usually stretched about eight feet above the ground, which will give sufficient height for from 10 to 12 trusses per plant.

If canes are used they should be inserted before the plants are a foot high. For eight feet high wires, 10 foot canes are most economical, six inches being inserted in the ground, and the top tied securely to the overhead wire. The reason that the spare portion of cane is left up in the air, is that the portion in the ground will eventually rot, when it may be cut off, and the operation repeated until it is necessary to splice another cane to it to get the necessary height. If the spare two feet is stuck into the ground during the first year, or only an eight or nine foot cane is used, it will rot at soil level and will have to be spliced before it can be used again.

One great disadvantage with bamboo canes is that much time is spent in tying up the plants, and perhaps a more serious one is, that unless the canes are thoroughly sterilised every year, any disease present is carried over from one year to another in that little core of soil in the

hollow cane, which might have been devised just for this purpose. Red Spiders too find a home in hollow canes, and in warm dry districts can be disastrous to the crop.

Stringing.

In the writer's opinion, the most satisfactory and labour saving method of supporting tomatoes is by the use of special string, known as tomato fillis. This may be obtained from horticultural sundriesmen, and is a special soft string which does not bite into the stem in the same way as polished or sissal string does.

A study of the diagrams will show clearly how this is attached to the plants, and if the instructions are carefully followed, no misgiving need be had about the plants falling down.

Fig. 17.

The string may be fastened round the plant itself, to a wire stretched along the ground directly under the overhead one, or to a short stick or cane, pushed well in the ground alongside the plant, as indicated in the drawings. When string is used, whether it is tied directly on to the

lant or to a ground wire, the method of training is the ame.

If the string is fastened directly to the plant, it should e placed round the stem underneath the bottom pair of eaves, and tied in such a manner that allowance is made or the growth of the stem. The allowance should not be oo much or too little, but should aim to allow for xpansion to the thickness of about a normal thumb. If oo loose, it may slip up and pull the bottom leaves off, nd if too tight, it will eventually cut into the stem.

After the knot has been tied, the loose end and the lack should be gathered in the hand, and wound firmly ut not tightly round the plant, in an anti-clockwise irection. The other end of the string should now be tied o the overhead wire, in the manner indicated, keeping a rm tension on the string, but not sufficient to strangle he plant. A little practice will soon show the correct ension. Make certain that the strings are perfectly erpendicular, as if the knot indicated on the drawing is sed, it will not be found easy to slide it along the wire. his particular knot is the outcome of years of experience, nd it will be found to be xtremely easy to release it t the end of the year.

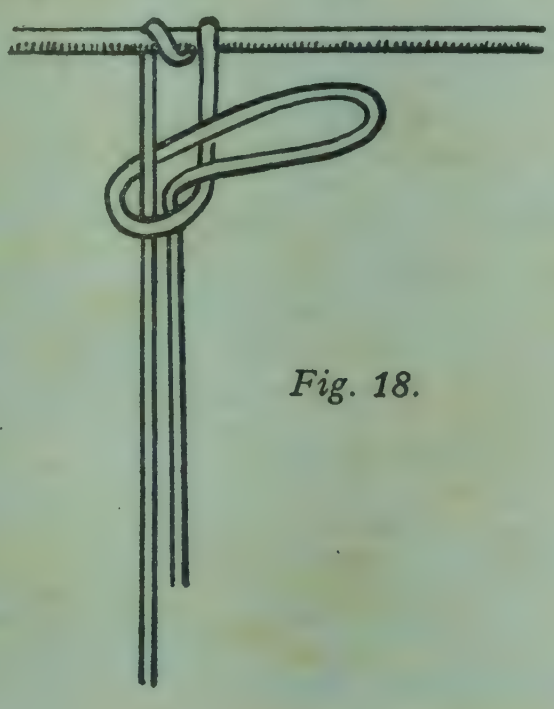


Fig. 18.

UBSEQUENT TRAINING.

Although the string is round round the plant under ach leaf when it is first tied, will be sufficient to pass round the plant under ach truss during the period f the plants' growth. This ill help to support the

weight of fruit, but will in no way check the flow of sap. In fact, it will be found in practice that the string is not wound round the plant, but the plant is actually wound round the string, always keeping to the same direction. This is most important, for otherwise the plant will tend to unwind itself, and may eventually fall down. In its natural state, the tomato plant uses its leaves to support itself in competition with other plants, by using its leaves as hooks in very much the same manner as a Nasturtium does.

Any other training consists of removing the side shoots as they appear. This however should not be taken too literally and every little side shoot removed, especially near the growing point, as the growth at the tip is extremely tender, and considerable damage can be done with the finger nails. It will be found on some occasions, that it is beneficial to allow side shoots to develop, especially when the leaves of the main plant are somewhat thin. Leaving the side shoots in for a week or two gives the plant a bigger area of feeding leaves, which will benefit the plant, and not take from it as is often supposed. This treatment however, should be used judiciously, and only when the plant appears to need it.

Another method favoured in the past, was to remove the growing point of the plant two leaves beyond the truss allowing the next side shoot to form the leader. The idea was that the pause in growth would enable the plant to concentrate on developing the fruit on that truss. Exhaustive tests have failed to prove this, and no merit can be claimed for it.

Stopping.

Considerable differences of opinion exist as to the merits or demerits of stopping tomato plants, but in the

writer's opinion this in many cases is a matter of convenience, and does not materially affect the cropping qualities of the plant. If there is space available, there is no reason why a tomato plant should not be taken to fourteen trusses. Generally speaking however, the greenhouse is often wanted for a crop to follow on, and the number of trusses which are allowed to develop will be dictated by circumstances. In an unheated house, it is far better to stop the plants by pinching out the top at two leaves beyond the fifth truss, rather than to allow the plants to keep on making fruit, which will never have a chance to develop to its full size, let alone ripen.

Removal of Side Shoots.

These should never be allowed to get so big that they have to be cut out with a knife, except under special circumstances, not only is this a wasteful misdirection of plant energy, but it leaves numerous open wounds into which spores of fungus diseases may enter the plant. It will be found that if the plant tissues are fully charged with water the side growths may easily be removed by the finger and thumb without tearing the tender skin.

If necessary, these side shoots may be rooted in a propagating case in the same way as ordinary cuttings, and the resultant plants used to extend the crop. If these cuttings are taken in June, they will make nice plants to continue the crop up to, and in some cases beyond Christmas, as they do not make such vigorous growth as seed sown during high summer.

Ridge and Roof Cropping.

In some greenhouses, it may be more convenient to plant tomatoes on the benches, or in trough like boxes placed on the benches. In this case, the plants should be staggered so that they may be trained up wires, stretched

lengthways from end to end of the house, and spaced about nine inches apart. If possible, they should be trained through eyes screwed into the main battens which support the roof.

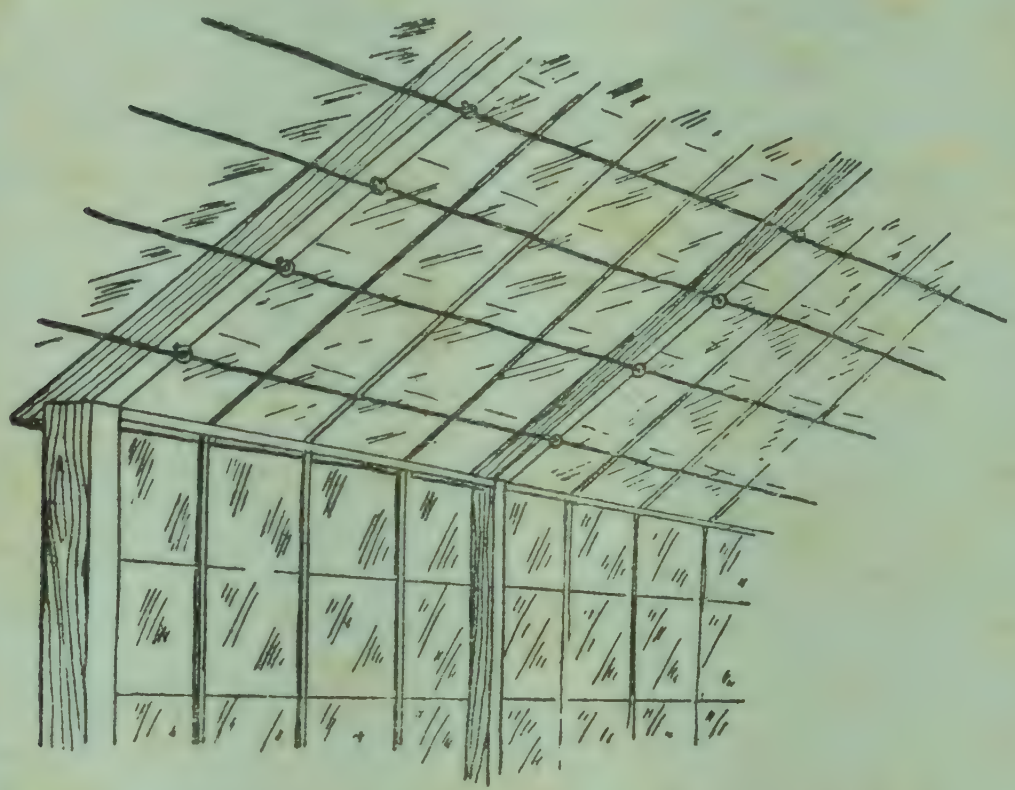


Fig. 19. The method of fixing wires for training plants in the greenhouse.

This will help to keep the foliage clear of the glass, and allow a cooling circulation of air between the plant and the heated glass. It will be found that the best quality tomatoes are grown in this way, as the plants are near enough to the glass to receive the maximum light, whilst the fruit will hang under the protective shade of the leaves. Even heavy trusses will hang at such an angle that they will not "neck" themselves. The vines should be tied to the under side of the wire, using the knot shown. The plants should be so staggered that each main vine has at least a foot clearance from its nearest neighbour.

Where space allows, and sufficient nourishment is provided in the soil, the plants from one side of the house can be trained up to the ridge and down the other side. Remove side shoots as previously advised.

Training Plants in Pots.

As a general rule, far too little thought is given to the training of tomato plants in pots, and in a small greenhouse, these can be made to look ornamental as well as useful. As a matter of fact, their use as ornamental plants rather than for eating was the main reason for growing them in the early days of tomato growing. The normal method of growing tomatoes in pots, is to train them up a single stake, in exactly the same way as used for plants in beds, stopping them at four trusses.

There are several variations however which may be used to advantage, especially when headroom is limited.

One way is to allow all side shoots to develop and stop them two leaves beyond the truss which appears on the side shoots. By adopting this method six and eight trusses of fruit can be obtained from one plant less than two feet high. The side shoots with their trusses may be supported from a single central stake by looping them to this, or each truss may be staked separately by pushing small canes down the side of the pot, and allowing them to slope at the same angle as the sides.

Another variation is to stop the plant when four side shoots have been formed, and fan the plant out as on a trellis. A ladder shaped trellis may be made by pushing two canes down the side of the pot, and tying others across these two like the staves of a ladder.

By this method, up to twelve trusses may be obtained in a limited height. The tomato vines may also be trained over a wire balloon allowing side shoots to

Fig. 20. A ladder shaped trellis can be used effectively.

develop so that the whole of the wire shape is covered. These look most effective, with the fruit hanging inside the frame. Varieties with smallish fruit should be selected for this purpose, and the cherry and currant types will provide a most intriguing display, especially if use be made of the red, yellow, and orange fruited varieties.

Pegging Down.

This is a novel method of training tomatoes, and single plants can be made to grow almost indefinitely, and

always producing fruit. All that is required is a fairly long trough about six inches wide, and six inches deep. A single plant is planted at one end, and when the first truss begins to bloom all the leaves below the truss are removed, and the truss itself removed. The stem is gently bent over and pegged with wire pegs to the soil. Side shoots which appear are trained upwards and

Fig. 21.

stopped at one or two trusses, depending on the height available. A stake is placed to each side shoot which in effect become separate plants. These should be thinned out to about a foot apart. The subsequent training consists of removing the leaves from the main stem, and pegging the main stem to the soil, partially burying it when it will form fresh roots, and the plant will maintain its vigour as long as there is any food left in the box. Thus you can have what looks like a succession of plants bearing fruit at one end, and tapering down to small plants near the growing point. A glance at the diagram will perhaps give a better indidation of the method of training employed

7

FEEDING AND WATERING

OF late years the so called "Feeding" of plants has tended to become something which is unrelated to their general culture, and to many people it has become a separate phase of plant growth, especially in relation to such crops as tomatoes. This is all the more regrettable, as the exact opposite is the case. It is all part of a necessary whole.

The reasons which have led to this way of thinking may be traced to the large increase in the number of unskilled amateurs who have tried to follow commercial methods in their small greenhouses. These commercial methods are directed to an economic end, often without regard to the quality of the fruit, and by the economic necessity to produce fruit at certain seasons of the year, either to compete with foreign importations, or to meet the demands of the market. Such devices as stripping leaves, and shutting the greenhouses down tightly to induce rapid ripening certainly achieve these ends, but it is often at the expense of the remainder of the crop. Some of these methods have been copied by the amateur for the same reasons, but lacking the knowledge and experience of the commercial grower, they have often come unstuck, and the crop has been a partial failure and the quality of the fruit poor.

This is to be deplored, as often the amateur has only room for a few plants, and poor cropping reduces the value out of all proportion to results that the commercial grower would obtain by adopting similar tactics.

Feeding is a case in point.

From the moment the tiny root emerges from the seed and comes into intimate contact with the soil, it becomes a separate plant with a character and potential all its own and soon starts to feed.

The soil in which the seed is sown should provide a sufficiency of raw material from which the young plant can manufacture its own food, and as it grows, it must have this supplemented by material more suited to its phase of growth. Such a need is recognised in humans and animals, but is often disregarded in plants, until, at some mystic signal, such as determines the date when marbles and whipping tops are in season, an outbreak of feeding occurs.

The seed contains a certain amount of concentrated plant food to provide the necessary energy to drive the root or radicle downwards into the ground, and the leaf bearing stem or "plumule" up into the air.

This food supply is limited, as would be seen if the seeds were planted at too great a depth, and it is this fact rather than instructions from a gardening encyclopedia which decides the depth at which to sow the seed.

If the soil has not been properly prepared, additional food making materials may have to be given even before the plants are removed from the pots or boxes and planted out in their permanent quarters. But this state of affairs should be avoided if possible.

It should be clearly understood, that it is not possible to FEED plants in the same sense as feeding a human being or animal. Food making materials, either in solid or liquid form may be applied to the soil, but there is no guarantee that the plant can, or will make any use of them. Further, no matter what the materials are applied to the soil, or in what state, immediately they touch the

soil, which also contains various chemicals, more chemical changes take place. So that a substance applied to the soil in one form may change so quickly that the plant may not benefit at all by such an application. In fact, the plant may benefit, or be harmed by the reaction, and not by the direct application. In addition to this, the condition of the plant's health, state of growth, weather and temperature, must also be taken into account when applying food making materials. As an example, it is found that during dull sunless weather, tomatoes need more Potash and less Nitrogen, and conversely, during bright sunny weather, the amount of Potash may be reduced, and the Nitrogen increased.

At the risk of making the whole job appear very complicated, it cannot be stressed too strongly, that to get the best results from any growing crop, " feeding," application of food making materials, cannot be a hit and miss affair.

A dog fancier will study the general condition of his charges, the brightness or dullness of their coats, their eyes, and the many other signs and symptoms which to the trained person are obvious, before feeding or dosing.

Like animals, plants cannot talk, but they too can give unmistakable signs of their requirements.

Food Requirements.

The three main food requirements of tomatoes are Phosphates, Potash and Nitrates, with one or two more elements in smaller quantities. These latter are known as "trace elements," but in most healthy soils these trace elements are found in sufficient quantities, and do not constitute a serious problem.

Of late years, their presence or absence has been over emphasized, but the reader can be assured that only in

rare cases do they affect the small grower. Here again the intensive methods of the commercial grower are responsible. It is true that some soils are deficient in certain essential element, but all too often the deficiency is caused by the over application of lime or fertiliser, rather than by under application.

Time of Feeding.

To make the subject more readily understood, I am adopting the use of the word feeding, and using it in the sense more generally understood in connection with tomatoes. And as I understand it, it is the application in dry, solid, or liquid form, some substance or substances to provide additional nourishment for the plant, generally at a time when an extra heavy strain has been placed on the plant, either by heavy cropping or when a heavy crop is desired.

With all plants, the time at which such feeding should commence is a matter of great importance, because, if it is applied too early, the plant may make more leafy or woody growth than is required, and the object of feeding is entirely defeated. In the case of tomato plants, this is not less important, as early application of the wrong sort of food under varying conditions may give entirely opposite results.

This is often why the amateur laments at the end of the season that he did exactly the same as he did last year, and although the crop last year was a good one, the results this year were disappointing.

No two years are ever exactly alike, hence no one is able to give a hard and fast rule, or a cut and dried formula. Under the circumstances, it would be much better if the grower could learn to assess the needs of a crop under any circumstances, rather than go blithely

on from year to year, trusting to providence that his treatment coincided with the prevailing conditions.

It cannot be over emphasized that the early treatment of a tomato plant materially influences its subsequent growth and yield, but far too often this is ignored or disregarded either from ignorance or carelessness. It is a matter of common observation, that the person who can raise from seed, and have the plants under his care during the whole of its life cycle, will get a better crop than one who receives his plants partly grown.

Growth should continue evenly and without check, and a plant so grown should not need any additional assistance in the way of feeding, until the additional strain of fruit bearing is upon it.

There are however occasions when some assistance is necessary, and if the young plants show signs of retarded growth, either from the fire going out accidentally, or a check caused by allowing the plants to dry out, which makes them thin, with wiry stems and thin blue to purple foliage, then some form of assistance is desirable. Nitrogen as derived from Sulphate of Ammonia or Nitrate of Soda is the accepted form of stimulant for such conditions, but with tomatoes, the top growth may be stimulated at the expense of the root system. It is better therefore, to use Phosphates in the form of Superphosphate of Lime at the rate of ONE teaspoonful of finely ground Superphosphate of Lime to ONE GALLON of water, making sure that this is thoroughly dissolved in the water, as superphosphates have a habit of rapidly settling to the bottom of the watering can.

The results from this may be much slower than if nitrogenous fertilisers are used, but the effect of these are

Note : To properly dissolve Superphosphate, make into a paste with warm water and add to the bulk of water.

stimulating rather than feeding, and may easily cause the loss of that cherished bottom truss.

A tonic, as well as a complete feed, may be given if necessary by watering the young plants with a weak dose of soot water. The liquid should be clear however, and of a light brown colour, black soot water does more harm than good.

In the Soil.

Plants in shallow soils are more likely to need "feeding" earlier than plants of the same age planted in a deep moist soil. On no account should dry or liquid fertilisers be applied to dry soil.

Watering is inseparable from feeding, as water is the vehicle by which the food is conveyed into and about the plant.

Very briefly the action is this :—

No solid matter however finely divided can ever enter into a plant, either through root or stem, but must be so soluble that it can pass through the delicate membranes of the plant cells, from root to growing point. More water is absorbed into the plant than is actually required for its daily needs, and passed out through the leaves in the form of water vapour. With a plant like a tomato with large vigorous leaves, a large amount of water is taken up and expelled through the leaves, hence the need for extra care with the ventilation, especially during dull sunless weather.

In addition, although plants can to a small degree select the material they want to eat, they often have to take up substances which they do not want. These are either stored in the tissue of the plant, or forced out of the roots again in the form of acids. Some of these help to dissolve insoluble substances, which are then taken up again by the plant.

Some substances such as phosphates and potash may be present in the soil, but yet be in such a state that the plant cannot make use of them, with the result that the soil may actually be poisoned by an excess of plant foods.

When the writer has been called in on numerous occasions to prescribe for sick tomatoes, it invariably turns out that the plants have been fed to death. For more often than not, if tomato plants begin to look sickly they are given large quantities of quack stuffs on the advice of well meaning friends and neighbours.

The behaviour of the plant is a far more reliable guide to its requirements than a particular date by the calendar, and in the case of the tomato, the indicators are the leaves and flowers.

The leaves of a strong healthy plant should be bright and fresh looking without being too brittle. When grown in a bed the plant is generally ready for its first drink after the first or second trusses of flowers are open, or opening. On a healthy plant, these should be of a good yellow colour. A deep yellow indicates that they have plenty of water, or they have a little too much Nitrogen in the soil. If the blooms are very pale, and the foliage is turning a dusty blue on the upper part of the plant, then they are in urgent need of water at the root.

Generally speaking, when the plants are about 12 to 15 inches high, they could be watered by can or hose pipe round the plants, each plant receiving about one third of a gallon per plant, the water being directed round the plant over the area covered by the leaves. This is known as ball watering.

At this stage of growth, it is far safer to use the watering can than the hose pipe, as the amount of water applied can be more accurately gauged. Furthermore, during the earlier part of the year, the water direct from the hose

pipe may be very cold, and so chill the roots that they become diseased and the plants die.

Care should be taken to see that the force of water either from can or hose, does not wash the soil away from the roots or splash the soil on to the leaves. Keep the spout as low as possible and keep it moving, as at this early stage the surface soil will be loose and easily washed away. If a spreader is used on the spout of the can, this should be made of rubber, as a tin water spreader can easily cut into the soft skin of the plant, and allow disease spores to enter the tissue. More damage is traceable to the spouts of watering cans than is generally realised.

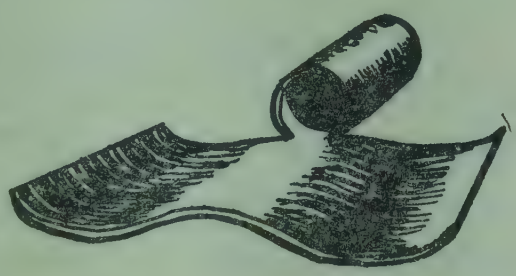


Fig. 22.

The next watering will be determined by the state of the weather prevailing at the time, if very hot and dry, this may be necessary a few days after the first. If in doubt wait about ten days, and give the same amount again, gradually increasing the circle watered as the leaves grow in size, until the time comes when the whole surface of the bed is watered.

By this time, the plant should have grown to about two feet to two feet six inches high, with the bottom truss nicely set with fruit, and one or two setting nicely on the second truss, with the flowers beginning to open on the third, the fourth truss in the bud stage, and the fifth truss showing clearly at the top of the plant.

This is an ideal state at which to start feeding, and if the beds have been prepared with wheat straw, the first feed should be one containing Nitrogen. It may take several forms, and in country districts, the best results are

obtained by giving a good dose of soot water at the rate of two gallons to three plants In industrial districts, the soil is usually impregnated with acids, and Dried Blood is recommended at the rate of one TEASPOONFUL of dry powder per plant, applied to the soil evenly and watered in.

When applying dry powders of any sort to the soil, scatter it round about a dozen plants, and water it in, rather than do the whole crop and then carry on with the watering. This is particularly important when Superphosphate of Lime is one of the ingredients, dry fertilisers tend to cake on the surface of moist soil, and remain there instead of being washed into the soil.

Where small batches of plants are grown, it is often better to mix the fertiliser dry, and put it in the watering can, making sure it is thoroughly dissolved. This does away with the application of lumps, which may easily poison the soil in their immediate vicinity for several weeks. Care however, should be taken to see that fertilisers such as Superphosphate and Dried Blood are thoroughly mixed with the water, as Superphosphate tends to sink to the bottom of the can, whilst Dried Blood will float on the surface. If Bonemeal or Boneflour is applied as a top dressing, this is better applied to the surface of the soil mixed with a quantity of good soil.

Feeding by applying soluble plant food should not be confused with top dressing, as this is generally regarded as the application of a fresh layer of soil or manure to the surface of the bed.

The advice often given to apply liquid manures or artificial fertiliser "little and often" is very sound, and although the recommended applications at intervals of ten or fourteen days is generally given, this should be regarded by the intelligent grower as being elastic and

not arbitary, as it may so happen that a period of dull cold weather follows an application of fertiliser, when neither watering nor more food would be advisable.

It is possible by varying the amounts of fertiliser to alter the characteristics of both plant and fruit. For example, if a comparatively small hard sweet fruit is required, nitrogen should be suppressed, and additional potash given; on the other hand, if a large weighty, albeit rather tasteless fruit is wanted, then potash should be reduced to the minimum, and larger quantities of nitrogen given. Such treatment therefore will be determined by the growers themselves, depending on their tastes and requirements.

Liquid Manure versus Fertiliser.

This is often a point which starts an animated discussion when growers get together, and I do not intend to come down on one side or the other, as each have their own particular qualities and uses. Where heavy applications of liquid manure are given, the fruit tends to be large and of poor flavour, especially if cow manure is used. Of recent years however, the value of animal manures has dropped considerably because of the lack of feeding stuffs, and during the summer months when much plant feeding is done, the animals receive little else but grass to eat, and consequently contain little of value to the plant.

For tomatoes, sheep or goat droppings are by far the best, followed by horse manure, mixed farmyard manure to which poultry droppings have been added, and lastly summer-made cow manure. Liquid made from such material should always be applied well diluted and perfectly clear. Here again, no definite dilutions can be given as only the grower is in a position to know the

initial strength of the manure. As a guide however, if bags of these various manures are suspended in a barrel or tub of water, only the lightest squeezing should be given to the bag, and on no account should the muddy residue be applied to the tomato beds.

As previously mentioned, all food which is absorbed by the plant must be in such a state that it is perfectly soluble and can be absorbed through the walls of the cell, and it is therefore useless to apply water which carries solid matter held in suspension. This mud-like substance remains on the surface of the pot or beds, and so prevents the air from entering the soil. During the growing season it may be seen that fine white roots will penetrate through this, and it will be argued that these like it so much that they have actually come up for it. The reverse however, is the case, the roots have become starved of oxygen and have risked their lives by exposure to air to come up to look for sufficient oxygen to carry on.

The best results are often obtained by judiciously mixing the plant's additional supply of food, thus, an application of artificial fertiliser may be followed by an application of liquid manure made from animal or bird droppings. This alternation will supply elements which may not be contained in one or the other. These feeds again can also be alternated with applications of clear water.

My own method however, is to apply weak solutions of fertiliser whenever any watering is done. Where possible, this is applied via the watering can when individual watering can be done if necessary.

A small supply of dry mixed fertiliser is kept handy, and about a teaspoonful of this is placed in the bottom of the watering can, so that the dipping of the can into the tank will thoroughly mix the fertiliser with the water. By

placing this box of fertiliser near the watertank, much time and labour is saved, and the plants receive a regular application instead of getting dollops which may give them indigestion.

It should be borne in mind however, that if this method is adopted, due regard should be had to the cumulative effect of such fertilisers as Phosphates and Potashes, as these tend to build up in the soil, but may not be readily available to the plant, until they are in turn again acted upon by such things as Lime and soil acids. The object therefore is to apply soluble foods which are readily available to the plant at the time when it most needs it.

For many purposes, plants may be regarded in the same light as human beings or animals, in that they require different foods at different periods of their growth. Nitrogen and Phosphates are required in larger amounts during the early period of their life, and when fruiting commences ; that is when the flowers begin to develop, additional supplies of Potash are needed. After a heavy crop has been produced—not necessarily ripened—the plant must be regarded as approaching old age, and infantile treatment should be given, plus a tonic to help to repair the ravages of heavy bearing.

As a guilde the following formulas may be used with every prospect of success :

Early Stage—from the time the first truss shows colour.

2 parts Sulphate of Ammonia.
1 part Sulphate of Potash.
2 parts Superphosphate.

Second Stage—4th truss showing colour.

1 part Sulphate of Ammonia.
2 parts Sulphate of Potash.
3 parts Superphosphate.

Third Stage—after 2—3 trusses have been gathered.

1 part Sulphate of Ammonia.
1 part Dried Blood.
3 parts Superphosphates.

These parts are merely a guide which must be varied according to weather, etc.

Increasing Nitrates in the form of Sulphate of Ammonia during bright sunny weather, decreasing Potash, and increasing Potash and reducing Nitrogen during dull weather.

All parts are by weight, and if a measure is used, it would be as well to weigh the contents of the measure generally used.

To the inexperienced, it should be explained that :—

2 parts Sulphate of Ammonia.
1 part Sulphate of Potash.
2 parts Superphosphates.

can read :

2 lbs. Sulphate of Ammonia.
1 lb. Sulphate of Potash.
2 lbs. Superphosphates.
or even 6– 6– 12, according to the quantity used.

WATER.

No hard and fast rule can be laid down as to the water a tomato plant requires at any given period, and I should be doing the reader a disservice to attempt to postulate every conceivable condition of soil and treatment.

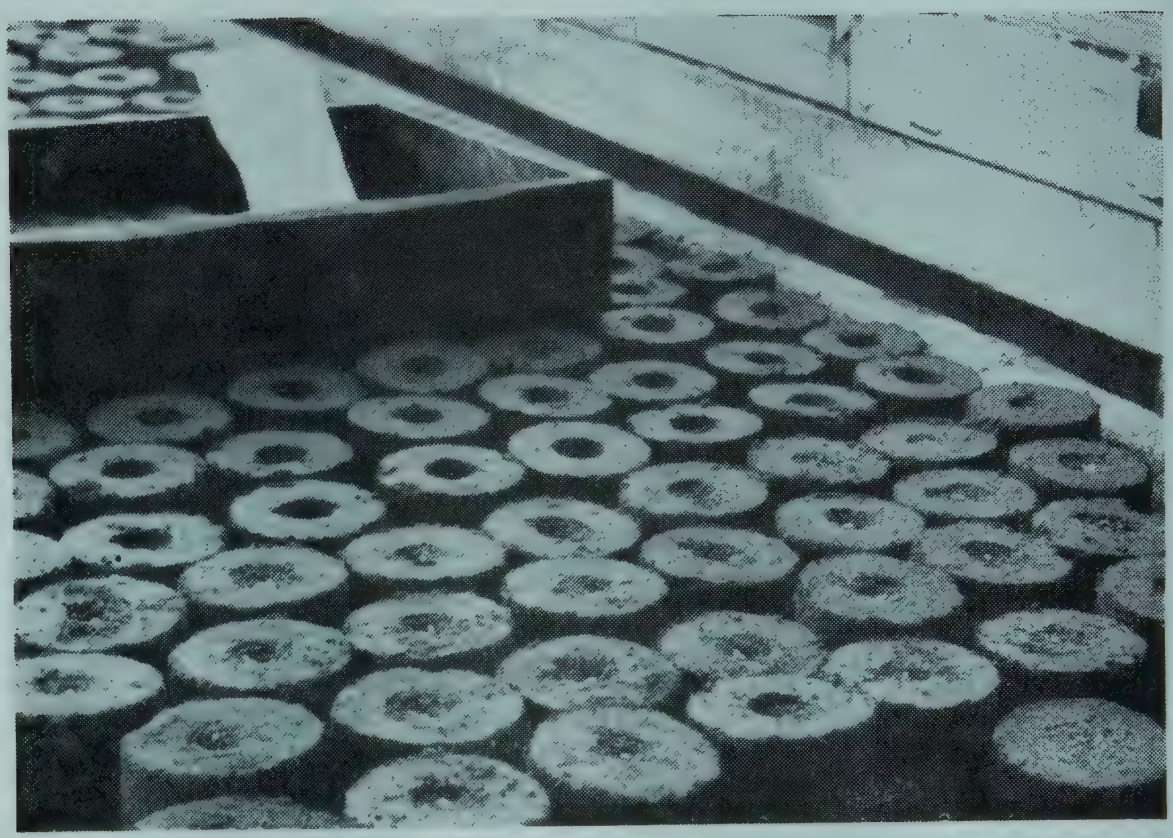
I can say categorically that it is a fallacy that tomato plants should be kept dry until they fruit. At no time should the plant be allowed to get dry at the roots.

There is a real danger that this can happen when the plants are grown in boxes, pots or on benches, but in well prepared soil the signs of dryness may be noted soon

Plate I

Making Soil Blocks.

Plate 2.



Seed Sowing : using soil blocks instead of pots.

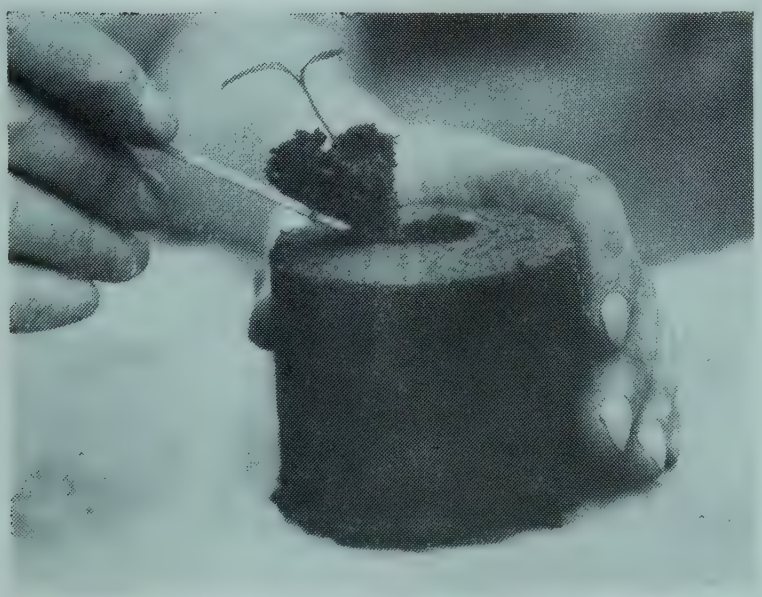
Plants growing in soil blocks.

Plate 3.

Tomato plants in soil blocks made from John Innes potting compost showing root development.

Comparative growth of plants of the same age.

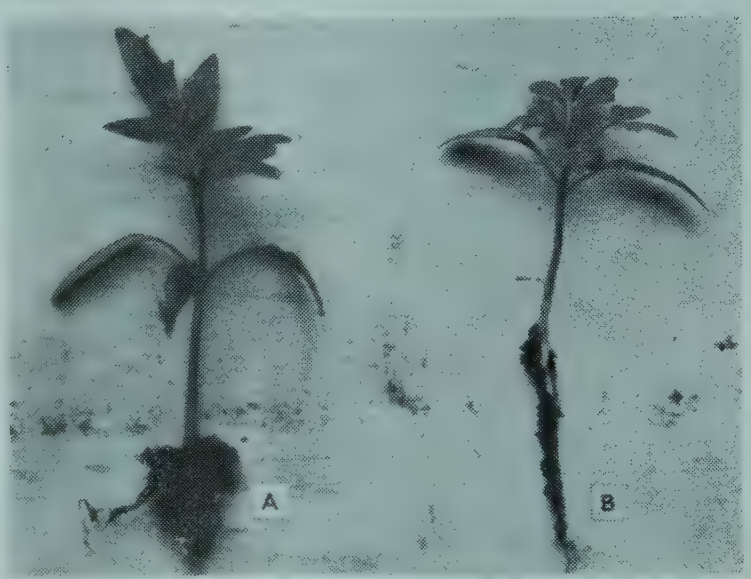
Plate 4.



Pricking out a young tomato plant.

A. A healthy seedling.

B. Rogue or Jack. Note position of seed leaves (cotyledons).



C. Seedlings which have been allowed to dry out.

D. These will make robust plants.

Plate 5.

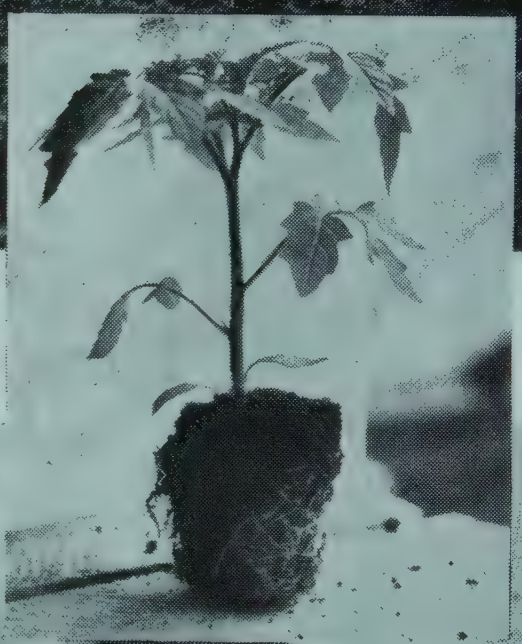
Preparing the bed, using wheat straw.

Four plants, averaging 20 lbs. per plant, grown by straw method.

Plate 6.

Above : How to layer a tall plant.

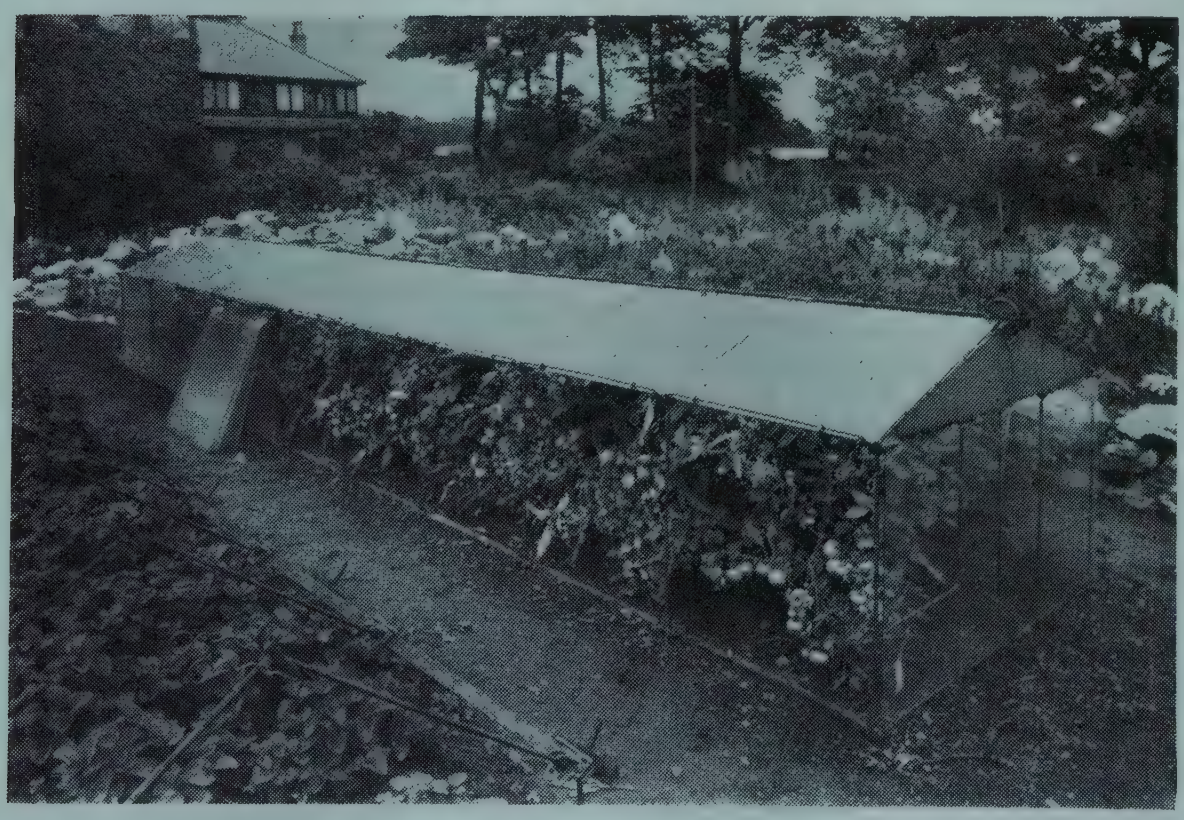
Right : An ideal plant ready for planting out.



The same plant, the next day.

Plate 7.

Method of training bush tomatoes.



An excellent crop of Stonors Dwarf Gem under a Taco Cloche.

Plate 8.

A 40lb. crop grown on a water tank 18″ × 24″ × 5″ deep.

Botrytis, or grey mould.

Mottling of the leaves caused by Mosaic.

enough so that steps can be taken to deal with it before much damage is done.

Driblets of water are of no use to any plant, especially in the summer time, as the water may easily be evaporated before you are out of the greenhouse.

It should be appreciated that as well as the demands of the plant on the water in the soil, much is evaporated into the air, some runs through the soil, and in the case of pots, little is retained of a gallon of water when poured on to a plant pot full of dry soil and plant roots.

Unless precautions are taken to ensure moisture in the soil, the crop may easily be reduced by half, partly because of "dry set," and partly because there is no moisture to spare to swell up the fruit.

Hose versus Watering Can.

As the season advances there can be no objections to applying water to the plants from a hose on the score of coldness, as the water from a tap may be warmer than that from a tank sunk into the ground. Running water from a brook or river is the coldest water in summer.

Watering may be done at any period of the day, the advice often given to water early morning or late afternoon, would soon have a grower in the bankruptcy court, or in a mental hospital.

Late evening waterings should be avoided whenever possible as temperatures usually drop sharply at night, and low temperatures plus wet soil may cause heavy condensation on the foliage. This in itself is not harmful, but it may provide suitable conditions for an invasion of mildew, or if insufficient ventilation is provided, fruit and leaves may be sun scorched.

8

FEEDING AND WATERING (continued)

IN addition to the materials mentioned in the previous chapter, there are certain other substances which can be applied to soil and foliage with beneficial results to the crop. They are applied (*a*) to replenish a deficiency, (*b*) as a preventative against disease, or (*c*) as a complement to the feeding already done.

Top Dressing.

The term top dressing is usually employed to describe the act of placing some specially enriched soil on the surface of the pot or bed in which the plants are growing. This may also be used in the case of Tomatoes, but I prefer to use partially rotted manure instead of soil. This material serves two purposes, one to provide a continuous if small supply of plant food, the other purpose being to act as a mulch for the conservation of moisture.

Watering is a laborious job, and it is better for the plants and the soil that it is not done too often, as continuous waterings tend to wash plant food out of the soil, and also wash the soil away from the roots exposing them to the hot sunshine and dry air.

A mulch of manure prevents this and helps to keep the soil cool and moist. It also prevents the loose soil from splashing the fruit so reducing risk of loss and damage from Buck Eye Rot.

Although the manure is described as partially rotted, this should not be too decayed or the covering will not last until the end of the season. The ideal material would

be farmyard manure (a mixture of all sorts of manure) or horse manure which has been stacked about three months, and turned several times. If there is a lot of straw in it, the very long stuff should be shaken out before it is used or it will make the greenhouse look very untidy, besides being difficult to manage.

Time of Application.

The best time to apply such a mulch is after the bottom truss has been gathered. This is for several reasons. The fruit hanging near the ground has been gathered so it is not liable to get dirtied, and the lower leaves which have become yellow and are therefore of no further use to the plant may be removed entirely, so allowing a free circulation of air over the ground and through the plants. The plants too have reached a stage when they require that little bit of extra nourishment that the dressing will give, and it saves the labour of carting in sufficient soil to cover the roots which have become exposed. What is probably of more importance, it provides excellent material to dig in for a succeeding crop.

If only cow manure is available, it should not be applied as it is taken from the byre, especially if no straw is used for bedding. Cow manure tends to clog the surface of the soil, and on a heavy wet soil may be actually harmful. Cow or pig manure is best composted with straw, and allowed to stand at least six months before use as a top dressing.

Removing the Leaves.

It is important when removing leaves from tomato plants before putting on the mulch, that no unnecessary damage is done to the stem, and a knife should never be used for this purpose. The leaves should be pressed upwards with the fingers or the palm of the hand until a

faint click is heard, and if the fingers are then closed round the leaf and pressed downwards the leaf will come away cleanly. The natural scar which is left will quickly dry up and heal over, especially if the job is done during a warm day.

Do not allow the leaves to trail or drop on the ground, but put these in a bucket rather than a basket and place on the compost heap. Do not leave stumps of leaves. These will only become affected with Bortytis and endanger the whole crop..

Application of Mulch.

It is a mistake to apply any sort of top dressing on the top of soil which is very dry and hard, as no bond will be able to take place between the two layers. This is especially so when soil is used as the main constituent of a top dressing, so see that the soil is nicely moist without being too wet.

The manure may be wheeled or carried into the greenhouse and applied direct to the bed, or tipped into heaps for spreading. Spreading should be done by HAND only, the squeamish can wear gloves, but it is only by hand that the manure can be evenly spread over the surface without damage to the stems. If a fork is used, there is always the danger that the bark or skin will be broken, thus allowing the entry of disease. I realise that I keep harping on this question of prevention of damage to tissue, but plants are in many respects like humans in that they are able to resist attacks of diseases provided that the spores or germs cannot enter the blood stream. Once the plant has been inoculated with a particular disease, especially those of the virus group, it may spread right through the house with amazing rapidity.

Spread the manure about three inches thick over the

entire surface of the bed and water it thoroughly. Only the amount of manure that can be washed in, either with a hose or with watering can should be applied at one time. The reason for this is, that if the following day is hot, the manure which has been put on will bake hard and become crusty and so trap much of the otherwise soluble matter, and this will not be available to the plant until the manure ultimately decays. Whereas if the manure is watered in as the work proceeds, the plants will benefit from the juices of the manure.

The amount of water that should be put on the bed will of course depend on the state of the soil before the top dressing of manure is put on, but it should not be so heavy that the ground becomes soggy. It should be borne in mind that the soil will not dry out again nearly so quickly after the mulch or top dressing has been put on, but at the same time care should be taken to see that the soil is moist throughout its depth.

Plants in Pots.

Plants in pots always present a special problem, especially during a hot dry spell, for even if they are only allowed to dry out for a few minutes the bad effects may be felt over a long period. One of the most common troubles being Blossom End Rot, which will be dealt with more fully under diseases.

There are several devices which may be used to minimise the harm done by drying out and which also materially assist to increase the crop. It is well known that the number of trusses which can be taken from pot grown plants will depend on the size of the pots themselves, and except under special circumstances not more than six trusses should be carried. In fact, four and five are more common.

One of the biggest advantages of pot grown plants is that they fruit a good bit earlier than those grown in the beds in the ground, but the same causes which make them early, also contribute towards the shortening of their lives. As the pots are normally exposed to strong sunshine and dry air is circulating around them practically all the time, the pot becomes very dry and in turn draws on the soil to make good some of the water losses. If the soil becomes dry, this will actually draw some from the plant, and the plant will extract some from the fruit, often causing heavy losses.

The first thing is to prevent the pots from drying out too quickly. If the pots are standing on the bench exposed to the full sun, the glass may be heavily shaded to about three inches above the height of the pots, but neither this, nor any of the other dodges should be employed until the pots are fairly full of roots, otherwise the advantages derived from using pots will be lost.

If wood is available, a plank extending an inch or two above the top of the pots could be used to shade them, alternatively slabs of slate or stone could be used. This method may also be extended when one or more rows of pots are standing on a bench to a board on each side of the rows, and the spaces between the pots filled up with weathered ashes or moist peat. Crops almost as heavy as those taken from the soil may be had this way, and at least three weeks earlier.

As it is practically impossible to thoroughly wet the soil in a pot after it has once been allowed to dry out, watering must be attended to most carefully. In fact, three times a day is not over much during really hot weather. This being so, it follows that much of the foodstuff, either contained in the original potting mixture, or any which has been applied since, must soon get

Fig. 23.

washed out through the drainage hole in the bottom. However, if the pots stand on a fairly thick layer of ashes, the food will be suspended in this and the roots will follow out of the bottom and make use of it. The layer of ashes on the bench serves two purposes, one to keep the plants cool and act as insulator material against the dry heat from the hot water pipes which are invariably under the bench. These ashes also provide an extra root run for the plant.

Mulching of plants in pots should of course be carried out in the same way as advised for the plants grown in beds.

Increasing the Size of Pots.

This can be done in several ways, but the two easiest ways are by using a metal collar or one made out of cow

Fig. 24.
Using a metal collar to increase the size of the pot.

manure and clay. The one selected will of course depend on circumstances, but the cow manure gives the best results.

The metal collar is simply a rectangular strip of flat galvanised sheeting. If buying this, ask for 20 or 22 s.w.g. galvanised sheeting, and get it cut into strips about three inches wide, and long enough to go round the top of the pots you are using with about an inch over lap at the ends. This collar may be tucked inside the top of the pot, and allowed to rest on the soil. This device will increase the depth of the soil by about $2\frac{1}{2}$ inches, and in terms of tomatoes may mean another pound per plant.

Cow manure and clay should be mixed together at the rate of two parts pure cow manure to one of clay, adding sufficient water to make it easy to mould around the top

of the pot to form a collar, which serves the same purpose as the metal one just described. The advantage being of course, that the roots can penetrate the wall as well as into the soil which can be put on the top of the pot.

The fastidious can use a bricklayer's trowel for this job, but it will take longer to put on unless the operator is skilled in the use of a pointing trowel.

Grass Clippings.

If no manure is available to mulch the plants with, lawn mowings may be applied in exactly the same way as advised for the manure dressing, the main difference being that no food material is present in the grass, but it certainly helps to reduce water losses. Reducing the number of waterings, of course increases the amount of food which the soil will retain.

Iron.

In addition to the bread and butter of the tomato plant diet, the plants also appreciate, and in some cases demand, something else. Iron is a case in point. A small amount of iron is essential for the well-being of plants and animals, but the full part that it plays in the make up of plants is not yet fully understood.

It is a fact however in the case of tomato plants, that it does help to promote healthy disease resistant growth, and puts a beneficial colour into the ripe fruit.

Although only a microscopic amount of iron is required for this purpose, it is a difficult job to get it into the plant through the roots, it is therefore useless to apply iron in any form to the soil with the certainty that it will be taken up by the roots. The best way of getting iron into the plant is to spray it on to the leaves. Two applications during the growing season is generally sufficient. The time of the first application should be when the plant is

showing the second truss, and the second application just before the first truss is turning colour.

Quantity and Method of Application.

A small quantity of powdered Sulphate of Iron should be purchased from the chemist, and a quarter of an ounce dissolved in 2 gallons of water provides a sufficient concentration. Spray all the plants thoroughly, choosing a dull but not wet day for the job, as the longer the plants are wet by the iron solution the better the results appear to be.

Exhibitors will be particularly pleased by the intense red colour the ripe fruit show when iron is used.

The Use of Permanganate of Potash.

Permanganate of Potash deserves to be better known as a cheap and handy fungicide. Tomato plants are liable to infection from fungoid diseases, and the timely application of a diluted solution of this is a cheap insurance against these diseases.

Two or three sprayings during the growing season is usually sufficient, but there is no reason why a daily spray should not be made if desired. Not only can Permanganate of Potash be used as a spray, but the plants may be watered with it from seedling to adult stage, as although it has little food value its fungicidal properties benefit the soil.

The first overhead sprays used should be made just prior to planting out, the second one just after the plants are tied up, and the third when the plants are about three feet high. (My plants so treated have never suffered from any disease over a period of 32 years).

With tomato plants perhaps more than any others, prevention is the best cure, as unfortunately most diseases of tomatoes are only curable by the destruction

of the plant itself, as when the signs of the disease are visible it has obtained such a hold that nothing can be done about it.

Where only a small number of plants are grown, the best plan is to dilute half an ounce of Permanganate of Potash crystals in a pint of warm water, and if this is corked and the bottle placed in the greenhouse, about a teaspoonful of this concentrated solution can be added to a gallon of water and either used as a spray or for watering young plants. The watering of adult plants with this solution appears to do neither harm nor good, although many amateur growers swear by its fertilising properties.

Epsom Salts (Magnesium Sulphate).

The time honoured use of Epsom Salts for various reasons has long been recognised, but it is only of recent years that it has been used to correct the mineral deficiences in plants. In tomatoes this deficiency is shown by the yellowing of the foliage, but as yellowing is also due to many other reasons, it is not easy for the layman to distinguish yellowing caused by magnesium deficiency. Fortunately, on soils in good heart this deficiency is not so common as one would imagine from the many articles which appear about it. Some soils are naturally deficient, and others are made so by the excessive use of unbalanced fertilisers or by liming heavily. Unless it is the former, the man who changes his soil every year does not have to bother about magnesium deficiency.

The correction of this deficiency is easily affected by spraying when yellowing appears with a solution of two ounces of Epsom Salts to one gallon of water. The crystals or powder may be applied dry to the soil, but a considerable amount more is required to give the same results, and works out to about an ounce to the square

yard. I must repeat however, that for ordinary garden work little trouble should be experienced by the grower from this cause.

When to Spray.

Whether the tomato plants are sprayed with iron, Permanganate or Epsom Salts, choose a dull but dry day. Do not spray in the evening or the cup like depression in the leaves will hold pools of concentrated solution, and as it may so happen that the sun will get out hot next day before adequate ventilation can be given, scorching of the leaves will take place. The aim should be to select a day which will allow the solution to remain on the leaves for an hour or so, so that the soluble matter may be absorbed into the leaf tissues. If the sun should get out hot just after spraying it will be advisable to gently shake the plants to get rid of the excessive liquid.

9

DEFOLIATING

THIS is another name for the removal of growing leaves from a plant, before they have become too old and decayed to carry out their normal and natural functions.

Opinions as to the desirability and wisdom of doing this are sharply divided, some arguing for it, and some against it, so it seems advisable to examine both sides of the argument.

The "Defoliators" claim that by removing growing leaves either by cutting them in halves, or by removing certain leaves covering trusses of fruit, the fruits will be exposed to the sunshine, and so ripen more quickly. Also the removal of leaves will allow air to circulate more freely between the plants, and so reduce the danger of disease. Under commercial conditions there may be some justification for this, but so far I have found no evidence to support this contention.

My own experience is that defoliation reduces the quality of the fruit and does not assist the ripening a scrap. In fact, the colour is poor, and air spaces form between the seeds and the outer covering.

Diseases such as Botrytis are more readily introduced, and the many open wounds invite infection by virus and fungus diseases.

If it is necessary to shorten the cropping life of the plant then the quickest way to do this is to strip off the leaves, and under certain conditions, such a step may be essential.

For the average grower, the removal of a healthy leaf

should be regarded as a sign that he has not yet learned how to grow tomatoes.

This is a strong statement, but I feel strongly about it. Firstly, if it is desirable that air should circulate more freely between the plants, then more space should be allowed between each plant. Fewer plants do not necessarily mean less fruit, but in many cases a bigger crop is taken. Alternatively, a less vigorous variety should be grown. Early and small fruited varieties do not produce such big leaves as a large fruited variety, and spacing should be arranged accordingly. In large greenhouses, the rearrangement of the direction of the paths or alley ways conducting the air through the crop may often be all that is necessary to improve ventilation.

In some cases heavy foliage and thick fleshy stems are produced by excessive nitrogen in the soil, either by giving dressings of poultry manure, dried blood, Sulphate of Ammonia, or Nitrate of Soda, or even by steam sterilising.

Too much water in a heated soil and continual overhead spraying will produce much the same effect.

Fruiting will often reduce foliage spread. Proof of this will be seen in overcropped and underfed plants. This reduction will appear about the fourth truss, when the tops and top foliage will run out very thin. Correct this unbalanced feeding by reducing or entirely cutting out the potash for a feed or two. (See advice on feeding during dull weather).

Rank manure of all kinds dug into the soil will also have a tendency to make very large sappy leaves. Like big flabby babies, such plants are liable to catch diseases more easily than firm stocky children or plants.

Every attempt should be made in the first instance by controlling the amount and quality of the food taken in

by the plant, but if in spite of this it is found that foliage must be removed, then only the barest minimum should be taken off.

Remove whole leaves which are interwoven with their neighbours by pressing upwards against the underside of the leaf close to the main plant stem with the edges of the hand. Continue pressing upwards until a click indicates it has broken, press down, and the leaf will come away cleanly from its socket without tearing the skin of the main stem.

Ripening.

Direct sunlight is not essential for the ripening of tomatoes, in fact, it can be proved that fruits green or just turning, can be ripened more rapidly in a dark drawer or cupboard than on a window ledge exposed to direct sunlight. Actually direct sunshine can do harm to fruits, and much of the patchy ripening and green back is due to the exposure of the immature *green* fruit to very bright sunshine.

This damage, which is very much like sunburn of the human skin is often done weeks before it is apparent in the swollen and ripening fruits. It will be observed that this trouble is more prevalent during seasons when bright sunshine occurs during the early part of the year, even if it is followed by weeks of dull weather.

Exhibitors particularly are advised not to remove foliage which shades the fruits earmarked for the show bench Cracking, both circular, and calyx to the flower point may be caused by exposure, as the skin will dry more easily and lose its elasticity, and a change to dull damp weather will cause bursting, even if no water is applied to the roots.

The leaves will take their share first, and act as a buffer

between fruit and root if water has to be given to keep the plant going.

Lastly, and most important, it is essential that leaf should balance root. Intake is controlled by output, and that fine balance between root and leaf should not be upset. Leaves play an important and vital part in the conversion of the raw materials absorbed by the roots from the soil water. They also act as radiators and cool the plant, giving off as they do, the excess water not required for the distribution of the food manufactured in the leaves, under the action of light.

Even the hairs on the surface of the leaves play a part in correcting and adjusting the rate at which the water vapour is removed from the leaf by a moving current of air.

There is nothing haphazard in the make up of a plant, and any liberties taken will be paid for in some way or another.

Some growers compromise by cutting the leaves in halves, and leaving the plant with half its foliage. In some years this may work fairly well, but during dull damp seasons much damage may be caused ; a grey mould, Botrytis, forming on the cut portion and working right back into the stem and killing the plant. If it is decided that leaves must be cut or removed, always do it on a hot dry day, so that a callous is rapidly formed over the cut surface.

Unfortunately, a wet day or evening always seems a good opportunity to catch up with inside jobs with the result that unless a warm day follows the wet one, the broken surfaces continue as running wounds, especially if the soil is wet, and the atmosphere charged with moisture.

Composting Tomato Leaves and Side Shoots.

Provided no disease is present in the greenhouse, there is no reason why the leaves and stems of the tomato plants

should not be composted. But as a large proportion of amateur tomato growers are not able to recognise a tomato disease until the plant dies, I am always chary about advising the inclusion of this material in the compost heap, especially if there is any likelihood of the compost being used in the greenhouse again. If this material is dug into the garden, then there is no reason why it should not form a valuable addition to the general compost heap.

See that the green leaves are well dusted with hydrated lime to destroy the fungus spores before adding any other material to the heap.

Gathering the Fruit.

Tomatoes may be gathered at any stage of their ripening, depending on the purpose for which they are required. The best way being to hold the fruit to be gathered in one hand, gently raise it, and at the same time press the thumb nail on the joint or knot of the stem. A portion of the stalk will then come away with the fruit, together with the green calys. It is most important that this stalk is left on the fruit, especially for exhibiting. Many dishes of tomatoes are disqualified every year, because this has been removed. The freshness of the calyx is a pointer to the freshness of the fruit.

Do not pull the tomato off the plant as this may result in torn trusses, and if the plants have been grown dry, the toughness of the stalks may result in the truss being torn off entirely.

Stopping.

Wherever tomato growers foregather, this is always a hotly debated subject. My own opinion is that, provided there is sufficient headroom (height in the greenhouse), no stopping is necessary. The mere fact of producing a

heavy crop is sufficient to keep the top growth within manageable limts. When tomatoes are grown in low greenhouses, or the crop has to be cleared by a certain definite time, then stopping is essential.

Stopping merely consists of removing the terminal growth, one or two leaves *above* the topmost truss. The two leaves are left on, so that the top fruit receives a supply of food on its way down the main stem.

The old practice of pinching the top out as soon as a truss is formed and taking up the top sideshoot as a leader, has nothing to recommend it. The idea being, that the damage to the terminal point made the plant think it was going to die, and would make it in a hurry to reproduce itself and ripen its seed.

If plants are topped too soon, a bushy growth forms on the top of the plant, restricting circulation of air and throwing an unnecessary strain on the plant. Far better to allow one or two side shoots lower down to develop, which in a favourable season will produce sizeable fruits.

Where practicable, the tops may be trained over the paths on bamboo canes, or if they are trained up the sloping sides or tops of a pit, they may be taken down the other side again.

Setting the Fruit.

Apart from actual disease and destruction of the plant, probably the biggest losses in crop are caused by the non-setting of the fruit. If the first truss is lost and two more at the fifth and sixth trusses, average losses may easily amount to 2 lbs. per plant.

Tomato flowers are self fertile, which means that the pollen produced in one individual flower when dropped on the stigma of the same flower will successfully pollenate, and fertilise the embryo seed already present. There are

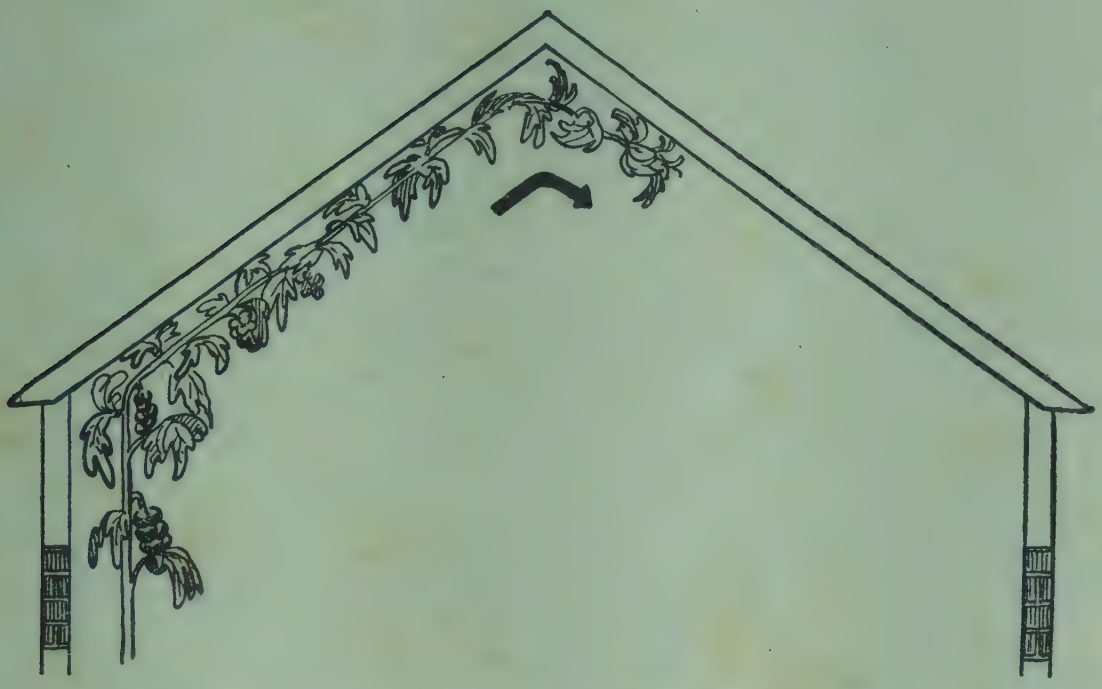


Fig. 25. Training tomato plants in the greenhouse.

however, several reasons why successful pollenation does not always take place, but at no time is it really necessary to take the pollen from one flower and transfer it to another one. The most common causes of partial pollenation resulting in one sided and distorted fruits, and non-pollenation and fertilisation which results in small seedless tomatoes are, a dry or very wet soil, low soil and air temperatures, and lank lush growth due to excess nitrogen. Another factor is that there is no movement of air through the plant because of bad ventilation, with the result that the pollen can become so damp that it is lumpy, with the grains holding together, or so dry that the pollen falls freely on to a stigma which has dried up, and is not sticky enough for the dust like grains to cling to.

Overhead Damping.

This very materially assists in the setting of the flowers, but is not of much use unless this is forcibly applied, as the movement shakes the flowers, causing the pollen to drop,

and as it is waterproof it can be borne by the water droplets on to the receptive stigma. At the same time, it should not be applied either with the syringe or hose at full bore, as this can easily damage the plant and break off trusses. The most effective and easiest way of controlling the spray from a hose is to place the finger or thumb over the end of the pipe, allowing the water to escape round the sides. With a little bit of practice this can be directed in the proper direction, and not down the would-be sprayer's neck. The same applies to the use of the garden syringe. The nozzle which gives a direct jet should be screwed on to the syringe, and the finger placed over the end in the same way as for the hose pipe.

Overhead damping to assist the setting of the flowers should not commence before the plants are tied or staked up, as irreparable damage may be done by knocking over the unsupported plants.

Times of Spraying.

The sort of weather experienced during a particular season will determine the time or times per day when this operation is necessary. In the damper North and Western parts of the country, it may be unnecessary to spray for weeks on end during dull heavy periods when the air is saturated with moisture. During such periods, shaking or tapping the overhead wires or the individual tapping of the plants being sufficient. During hot dry periods, two or even three sprayings during the day may be necessary, and records over many years have shown that there appears to be little differences in the results no matter what time spraying takes place, provided it is not left so late in the evening as to keep the plants wet all night. This practice should be avoided. Natural pollen drop appears to be greatest between 4 and 5 o'clock in the

afternoon of a normal summer day. This may be tested by gently flicking the petals of individual flowers with the forefinger. A useful implement for tapping individual flowers may be made by wrapping a wad of cotton wool around the top of a bamboo cane, and tying it in position with soft wool. Walking quickly along the paths, each plant can be tapped without any fear of damage to the skin, and will also ensure successful setting. It will be found that this tapping becomes unnecessary as the season advances as more air can be given. But during late spring and early summer, although the sun may be very hot, the wind may be very cold, and the introduction of cold air into the greenhouse will defeat the object in view.

For the man who has to leave his greenhouse all day these practices are not always possible, but since the introduction of summer time, the actual return home is usually early enough for syringing or spraying to be done then. If this is done immediately on the return home and the doors and ventilators closed whilst he is having tea, the necessary conditions will be created.

Spraying and damping should not be a hit or miss job, but should be done whenever the inside conditions are very dry, as flowers with their reproductive organs do not last very long in a suitable state for pollenating. If the greenhouse is near the dwelling house, an alternative is to instruct a member of the family to pour a can of water on the floor of the greenhouse especially if the paths are made of concrete.

Concrete paths do more to prevent the setting of fruit than is generally appreciated as these will extract moisture from the atmosphere, and as many greenhouses are at least one third path, it can be seen that a large amount of vapour is absorbed. Proof of this can be had if water is poured on to a concrete path during a hot day, when the

path can be heard literally sizzling. When the water is poured on the path at midday, all door and ventilators should be closed for about an hour, when they may be opened again. To overcome the disadvantage of a cement path they may be covered with ashes, and wooden duck boards used to walk on. Earthen paths are of course more satisfactory when good tomato fruits are the main consideration.

10

TOMATOES OUTDOOR

ALTHOUGH tomato plants are hardier than is generally appreciated, growers have not yet evolved a strain that can be relied upon to stand up to the rigours of an ordinary English spring without some form of protection. Protection is necessary in the early stages so that the plant may get a good start and to enable a satisfactory crop to be taken before cold nights and the shortening days of late summer come along to stop growth, otherwise large quantities of unripened fruits will be left on the hands of the grower.

That the plants themselves will grow, can be seen by the vigorous growth made by self sown seedlings, but vigorous growth by itself is a poor return for labour, and the fruit on such plants seldom reaches a useful size and rarely ripens.

In the more favoured and the southern parts of this country, very profitable crops may be taken outdoor without protection, provided strong well hardened plants are put out when all danger of frost is past. Further north, protection of some kind throughout the year is essential if the fruit is to be worth the picking, unprotected fruit being weather beaten, coarse and unattractive.

Even in the south, some form of protection from strong winds is advisable, for given shelter, earlier plantings may be made, thus extending the growing season.

Site and Soil.

In most gardens a sheltered spot can be found under the lee of a wall or even a fence, but in these situations extra

care should be taken to see that the roots of other plants do not rob the tomato plants of food or moisture.

On the other hand the site selected should receive as much sun as possible and be handy to a water supply, as sheltered sites are usually dry.

The soil should be in good heart, and be capable of holding water during the dry summer months, but no great preparations are needed as any soil which is good enough to grow a decent crop of anything else, is suitable for tomatoes.

Although tomato plants are generally regarded as gross and heavy feeders, it is a mistake to add large quantities of animal manure to the soil, as this will have the effect of producing rank growth and in a wet season huge misshapen fruit. Such plants are also more liable to disease. If the site selected is at the base of a wall, it would however be better not to rely on the existing soil, as this is often very dry, and more often than not exhausted by continuous cropping, or because of the roots of wall climbers or creepers planted there.

A better plan than excavating the existing soil is to build up a low retaining wall of any suitable materials at hand such as old bricks, boards, slates or even turf. The inside of the retaining wall should extend not less than 18 inches from the side of the wall or fence, and should be not less than nine inches high from ground level. If this retaining wall is being built along the house side, take care that any ventilating bricks are not covered over, as this may cause dry rot under the floor boards.

Break up the bottom of the cavity or trough formed by the low wall, and fill in with good soil, or chopped turf if available, to which has been added a half a bucket of well rotted manure or a bucket of compost to every barrow load of soil. Reckon four buckets of soil to one barrow load if

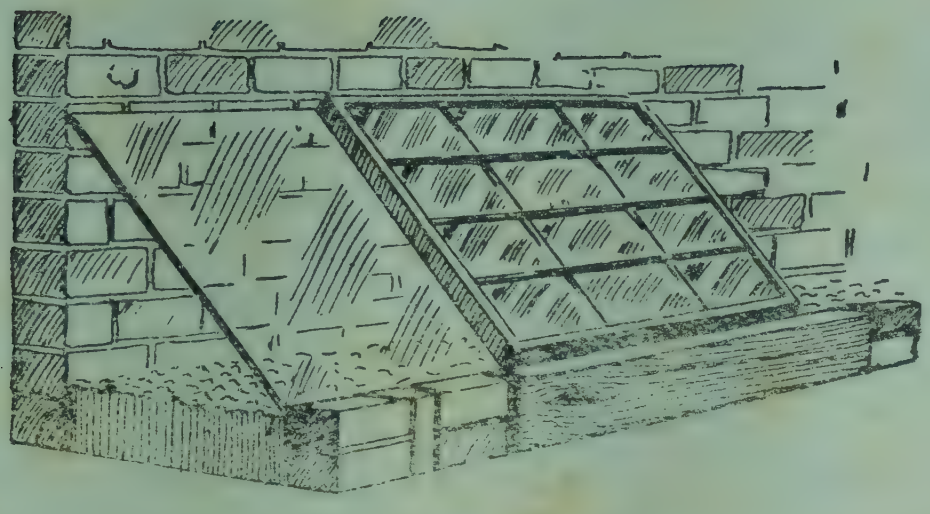


Fig. 27. Growing tomatoes against a wall.

a barrow is not available. To this soil and manure, add a 5-inch potful of bonemeal and two eggcupsful of Sulphate or Muriate of Potash, and two 5-inch potsful of lime rubble per barrow load. Failing lime rubble, use a handful of hydrated lime. Mix it all together very thoroughly, and fill this into the space between the house or fence and your little low wall. Carefully tread the mixture down, taking care that the sides don't bulge out, and top up again if necessary after treading.

Then give the whole a good watering and leave for at least a week to settle down and to warm up. To help the warming up process, cover the filled in trench with odd sheets of glass, cloches, or old frame lights tilted up against the wall.

It will be found that this method of raising up the bed is far better than growing them on the flat, as the whole bed will be much warmer and it is much easier to keep the plants supplied with moisture.

If preferred, the straw method advised for use in the greenhouse may be adopted instead.

Planting.

If plants are purchased in pots or boxes, far more satisfactory results will be obtained if the plants are stood in the pots or boxes for about a week on the top of the soil under the glass which is helping to warm up the soil. This will give the plants a chance to get used to their new conditions, especially if they have not been previously well hardened off, they will not then suffer the double check of transplanting and change of conditions.

The plants should be planted not less than a foot away from the wall or fence, and suitable wooden stakes or strong bamboo canes should be inserted in the ground alongside the plants at the time of planting. These stakes should be inclined inwards toward the wall to which they can be secured to a wire stretched along for that purpose, or more simply to a nail driven into the fence. The main reason for inclining the stakes is that the trusses of fruit will always hang down vertically with their own weight, and they will have the protection of the leaves, and also have the benefit of the reflected heat from the wall. As previously stated, direct sunlight is not necessary for the ripening of the fruit.

Time of Planting.

Such a position as advocated lends itself admirably to the use of electric soil heating cables, as power can be taken from the house supply, and if these are used in conjunction with some form of glass protection, the plants may be put into their fruiting quarters three weeks to a month earlier. Generally speaking however, it is not wise to put young tomato plants out into the open ground until the last week in May or even early June, although the time of planting will vary according to local conditions. The main thing to remember is that although tomato

plants are pretty tough when they are well established, they will not stand frost or cold winds.

If the soil is reasonably moist at planting time, the newly planted plants will not require watering for at least a week, even with glass protection over them. Water around the plants until they are well established, but during the early part of the year use water with the chill off. Do this by either standing the water in the sun, or by adding hot water to the watering can. Blood heat is just right, so if you plunge your hand in the water and it feels neither hot nor cold, then it is just right for the plants.

Planting in the Open.

Where larger plantings are required, select a position which is sheltered from the prevailing wind, and one which is handy to a good water supply. My own method is to plant in double rows, with a pathway between each pair of rows.

Fig. 28.

By planting this way, each plant has the protection of the neighbouring row. In the double row the rows are two feet apart, and the plants in the rows are eighteen

inches apart. Stakes are put in at the same time as the plants, and are inclined inwards to a wire stretched down between the rows. This allows the fruit to hang into the middle of the row where the leaves protect the fruit from cold wind, and at the same time allows a free circulation of air over the fruit.

If the plants are tall enough at the time of planting, they should be given an immediate tie to the stake, and additional ties should be added about every six inches as the plant grows.

Soil for Open Planting.

Tomatoes will grow in any soil, but prefer a medium to heavy one provided that the drainage is good. A dry hungry sandy soil is not so satisfactory, as unless the rainfall is sufficient, heavy waterings must be given. However, the dryness of light soils can be partly overcome by summer mulching.

Little manure should be added to the soil, but what is dug in should be well mixed with the soil, and the same quantity of fertiliser applied as recommended for greenhouse culture. Alternatively a good grade of specially prepared base fertiliser may be dug in according to the manufacturer's directions. It is not necessary to add large quantities of peat or similar material to the soil. Such dressings are best applied as mulches when the two bottom trusses have set.

Almost any part of a garden may be used, except that which has carried potatoes or tobacco as these belong to the same family, and there is a possibility that disease spores may be carried over from the previous crop. The soil should be made moderately firm by treading, but this should not be done when the soil is wet or it will become puddled and hard to work.

Subsequent Culture.

The treatment of plants outside is little different from that of plants under glass, except that it may be necessary to hoe round the plants occasionally to keep down weeds. After the second truss has set this can be discontinued when the mulch is applied, otherwise considerable damage will be done to the surface roots. Side shoots should be removed, but do this before they get more than three inches long, as outside they are generally tougher than those under glass, and especial care should be taken to see that no tearing occurs when they are removed. As many leaves as possible should be retained, and only those which are damaged, dead or useless to the plant should be removed.

Generally speaking, the number of trusses on most varieties should be restricted to four per plant, for although a well grown and healthy plant will make many more than this, it is seldom that the season is long enough to ripen more. Except in very dry seasons or against a dry wall it is not essential to spray the flowers to assist the setting of the fruit.

Feeding.

This should not commence too early, and is considerably different from the feeding methods recommended under glass, as too early and too much feeding will produce a lot of unnecessary and unwanted foliage, and the crop will consist of large misshapen tomatoes. The main reason being that little control can be exercised over watering particularly during a wet season. It follows therefore, that if feeding materials are applied they will be washed in with every rain, and this may happen at a time when the crop should be ripening. If the soil is in good heart to start with, two or three feeds are all that are

required during the growing season, and in a normal summer with a fair amount of sunshine, can consist of :

3 parts Superphosphate of Lime.
2 parts Sulphate of Potash.
1 part Sulphate of Ammonia (all by weight).

This should be mixed thoroughly, and a dessertspoonful of this mixture added to a 2-gallon bucket or can of water, dissolved and applied to three plants.

Liquid manure and heavy applications of nitrogenous fertiliser should be avoided if good quality fruits are required. During a wet season excellent crops can be taken with no feeding at all, with the exception of fortnightly applications of Sulphate of Potash.

Bush Tomatoes.

These are becoming deservedly popular, as if properly grown they give a heavier crop of fruit per plant than the ordinary upright growing kinds. Theoretically, a bush tomato plant should be allowed to grow unrestricted, but in practice the garden soon would be full of unwanted growths, and little useable fruit would be produced. The following methods have been found to give the most satisfactory results, particularly with the varieties of the Dwarf Gem type.

Training.

The plants may be planted in the same way as advised for open planting, but it is unnecessary to incline the stakes to a wire stretched lengthways between two rows. Each row should have a wire to itself, about two feet six high. No stakes are necessary for the plants themselves, as they may be trained up strings fastened to the plant itself or to a small stake or cane pushed into the ground at the base of the plant. The first supporting string may be tied loosely round the base of the plant

nd taken straight up to the wire overhead, leaving ne plant to make unrestricted side growth. When the lants are about 12–15 inches high all the side growths nould be removed, with the exception of two strong ell placed shoots as near to the ground as is possible. wo additional strings should then be tied to the base f the plant and trained up fanwise. One on either de of the main vertical stem.

On no account pinch out the main growth until the verhead wire is reached, as if this is done, it will induce a nultiplicity of side growths and the plant will need onstant attention. By the time the main centre growth eaches the overhead wire, the side growths will have got wo-thirds of the way up their own string. When these each the top, the growing point of each side growth may e removed in the same way as the centre growth. This nethod of training gives three main stems to each plant, nd as each stem can comfortably carry six trusses, as nany as eighteen trusses weighing from half a pound to a ound each may be taken from each plant. Trained in his way, the plants will naturally require more room in ne rows, and the rows should be two feet apart, and the lants two feet between them. The alleyway between ach pair of rows should be about two feet six inches wide, nus allowing room for cultural operations.

ULCHING.

During hot dry weather, tomatoes of any variety will enefit from a mulch of compost, half rotten manure, or wn mowings, in fact almost any organic substance which ill not stick together when it becomes wet will do. As ne crops grown outside by the amateur are not generally such great economic importance as those grown under ass, there is little restriction in the substance which may

be used as a mulch, as its function is mainly to prevent loss of water by evaporation.

Frame Culture.

Good crops of excellent quality can be taken from an ordinary cold frame without any heat except that supplied by the sun. Their nearness to both glass and ground seem to be to the liking of the plant, and it is surprising that the ordinary cold frame is not more often used for tomatoes. This being more often given over to the cultivation of cucumbers which may have to be given away, whilst tomatoes may have to be bought for the family.

To get the essential depth in the ordinary frame, it may be necessary to either lift the frame about a foot, or the necessary depth may be obtained by taking out some of the soil inside. In an ordinary wooden frame four feet by six feet, three plants may be grown, which in a favourable season will produce 12—18 lbs. of fruit. Some of the old soil should be removed from the lower end of the frame, and replaced by a bucket or two mixed as recommended for outside culture at the base of a wall.

The plants should be put in about six inches from the lowest part of the frame and trained up to the highest part on canes suspended on two wires (diagram 29). The plants should be tied on the under side of the cane, and care should be taken to see that they do not run wild, as it is essential that there should be a free passage of air between the glass and the top of the plant. The fruit will hang into the frame and care should be taken to see that it does not touch the ground or much of the fruit may be spoiled by slugs.

As considerable control of ventilation may be obtained in frames, and soil heating cables may be buried in the soil, plantings may be made earlier than recommended for

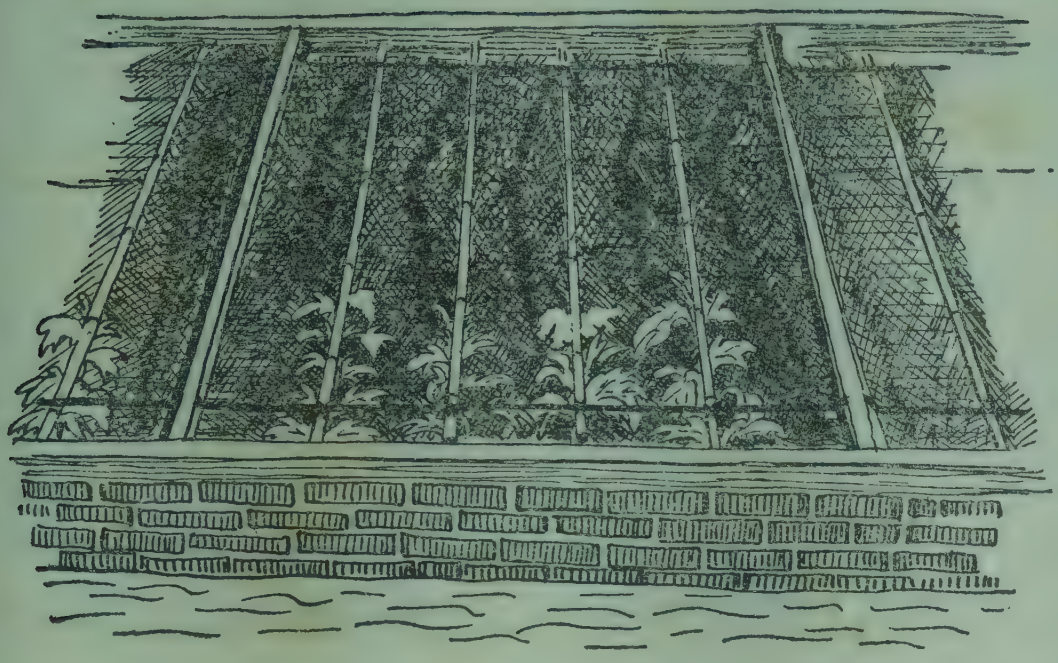


Fig. 29.

utside. By using a heated greenhouse, cold frames and utside planting, an excellent succession of fruit may be naintained throughout the season from very small units. he method of cultivation is the same as for greenhouse ulture, and consists of removing side shoots and training o a single stem.

ATERING.

Plants in frames should not be watered too heavily, or it ill be found that the fruit may split more readily than hen grown elsewhere. This is due to the fact that the ots will find their way outside, and that during wet eather considerable quantities of water will run down the ass and become available to the roots. During sunny eather which may follow, the temperature near the glass nder the frame can become extremely high, and this mbined with the saturated condition of the soil may ump up the cells of the fruit faster than the skin can

expand, and fruits may crack even in the green stage. The same caution should be exercised when applications of fertiliser are applied, and due regard should be had to the weather conditions prevailing during the season when fertiliser is applied.

Ventilation.

This is easily provided, and during high summer the frame top may be slid down entirely during the day time and pushed over the plants at night, always allowing a certain amount of ventilation except during the coldest days of the year. Even then the frames may be left slightly open and the aperture covered with coarse sacking.

Cloche Culture.

There is no lack of types of cloches from which to choose as they range in height from two to seven feet, and may be had in either lean-to or span roof models. These taller models will accommodate tomato plants to their full height without de-cloching, the culture being practically the same as in a cold greenhouse. Under all types of cloches, the plants may be raised in heat and hardened off, or the plants may be purchased and planted out in early May or June. The precaution should be taken however, to place the cloches in position at least ten days before planting takes place so as to warm up the soil.

Soil under Cloches.

It is of the utmost importance that the soil under cloches should be kept in good heart by the application of compost, old rotted manure, peat or a good organic base fertiliser. This is particularly necessary, because it is not always easy or convenient to add this during the growing season, for the simple reason that the ground should never be free from crops, as quick manuring salad

crops should be grown with the more permanent occupants.

Plenty of organic material should be dug in at a suitable interval, such as after the tomato crop has been removed. This treatment is particularly necessary when only a restricted area is available for cloche grown tomatoes, as great demands are made on a small area of soil. The addition of organic matter also reduces the amount of watering, as this material acts as a sponge and holds the water.

Raising Tomatoes for Cloches or Frames.

Plants may be raised from seed sown directly into the soil under small cloches, or they may be raised in boxes of light soil placed on the shelves of the taller types. This is only possible in the warmer parts of the country, but it cannot be over-emphasized that where it is ultimately required to plant out either in the open or under cloches or frames, the plants should be raised as cool as possible, and the natural impatience to see the plants growing away very quickly should be curbed. The use of any fertilisers of the growth forcing type should not be employed, as this will only result in plants of unbalanced growth.

Subsequent Culture.

For growing under the lower types of cloches, plants may be either raised in heat, or specially hardened off plants may be purchased and planted out under the continuous type cloche in May or June. Unless the plants are trained horizontally the cloches should be raised on bricks or special adaptors to increase the period of their useful coverage. So soon however as the plants reach the top of the cloches, they should be removed and stacked carefully out of harm's way.

Under the taller cloches, this is unnecessary as the plants may be allowed to grow to their full height.

Hardening Off.

Hardening off is so important especially for tomato plants that it would be perhaps as well to describe this process in more detail. If the plants are being raised in a heated greenhouse by the grower, the first move the plants receive should be from the warmest end of the greenhouse, which is usually next to the boiler, to a cooler position. This takes place when the plants are about four inches high. Where this is not practicable, they should be transferred after about a week to a cold frame which receives as much sun as possible. For the first few days the frame light should be kept tightly closed, and no air admitted unless the sun becomes very hot. After this, increase the ventilation by raising the frame light about an inch, rather than sliding it. Even then the greatest care should be taken to avoid draught, and it may be necessary to hang coarse mesh hessian or sacking over the open portion of the frame. This precaution is all the more necessary when the grower is away from home all day, as the sacking allows air to circulate without causing a draught.

After a day or two in this position, the frame light can now be slid about an inch or two down its runners, still covering the opening with the sacking. It should be noted that in the ordinary type frame, ventilation should be given from the top or the highest portion of the frame. A simple device to cover automatically the opening with sacking or hessian is to tack it to the upper edge of the frame light, and weight it at the bottom with a piece of wood nailed to it. The result is that the frame light can be pushed up and down and the open space is automatically

overed with the sacking, but care should be taken to see hat the material used is of a sufficienctly open texture as ot to obscure too much light.

After a fortnight of gradual hardening off, the frame ght may be raised above the level of its runners, by aying two stakes or flat pieces of wood across the slide ars, thus forming a lid which keeps out heavy rain but llows a free circulation of air underneath it. Keep the rame light in this position until the weather is favourable nough to remove the light entirely, when the plants may e put into their permanent quarters, either under cloches r outside.

The actual time at which the plants may be removed rom the greenhouse must of course be determined by the ocality, but generally speaking, the second week in May s early enough so that the plants may be gradually and horoughly hardened off, when they will withstand almost nything except sharp frost.

11

PESTS AND DISEASES

PESTS and diseases are regarded as inseparable from tomato growing, and in some quarters are regarded as part and parcel of crop routine.

This need not be so if scrupulous care is taken with regard to greenhouse hygiene, as outlined earlier in this book.

A few minutes care and the necessary steps taken at the right time will do more to ward off attacks by pests and diseases than any later measures.

To illustrate this, the appearance of even one greenfly or a discoloured leaf should be sufficient to warrant steps being taken to prevent further spread.

PESTS.

Greenfly (Aphis). These may be found more generally during the early part of the year when the plants are small, but as the foliage increases in size and toughness, attacks are less likely except in the case of sickly plants ; it is seldom that adult plants are attacked. Plants under frames and cloches during cold seasons are the exception to this general rule, as apparently the aphis are driven under shelter out of the way of heavy rain.

These pests are more prevalent when lettuces are grown in the soil, before, or with the tomato crop, and as it may not be practical to spray or use an insecticidal dust on these, fumigation with nicotine shreds or other vapourising compounds and smokes should be carried out. All spare leaves after cutting the lettuces should be

immediately removed, as the fly will quickly move to more tender feeding grounds.

Weeds are very often hosts for greenfly, and one of the worst of these is groundsel, so see that weeds are never allowed to develop in the tomato beds or boxes.

Hot air conditions favour the breeding of this pest, and strict attention should be paid to the heating and ventilating of the greenhouse to ensure firm vigorous growth.

Healthy plants will resist attacks, but the sweet sap of sickly plants encourages them. The ailing plants can get so infested that the attack by pests which is secondary to the disease, may make the plant so ill that it cannot recover.

When a plant gets to this stage it is best pulled up and burned replacing it with a healthy one.

REMEDY.

Fumigate by using a special nicotine vapourising compound, although this is being superseded by the more easily handled cones, nicotine shreds, etc., the vapourising method has still much to recommend it.

Fumigation with the newer cones which contain a charge like a firework are particularly good, as when these are lighted they give a mild explosion and puff the dust and vapour into the air before the insects have a chance to escape.

It is particularly important when using these 'smokes' and other proprietary devices that the makers instructions are strictly followed.

Whatever method of fumigating is employed, a still quiet windless evening should be selected for doing the job.

This is because any movement of air in the greenhouse will waste the fumes, and also because the moving air

passing over the glass will actually draw out the air and the nicotine fumes from inside.

Many people are in a quandary regarding heat and moisture when it comes to fumigating, and are not certain even whether the fire should be drawn.

Generally speaking when any fumigants are used, the air and foliage should be dry, more so when any Cyanide preparation is used, as the moisture on the leaves tends to absorb some of the chemical and the leaf tissue is destroyed.

Bright sunny conditions sometimes have the same effect as moisture, hence evening fumigation.

The makers' directions on all preparations should be closely followed, for although tomatoes will survive Cyanide fumigations, this stuff is fatal to Chrysanthemums and French beans, and many other occupants of a mixed greenhouse.

Nicotine Dusts.

These are excellent against Greenfly, but they are far more effective in their action if the temperature is over 60 degrees F. so that vapour is given off. Derris and Pyrethrum powder may also be used—apply with a special blower.

White Fly.

This pest is becoming increasingly serious, and at least five species have now been found on tomatoes. Another disturbing feature is that it is becoming hardier and more resistant to cold conditions, and the writer has even found hatchable eggs on the underside of privet leaves in mid-winter.

This pest seems to have an uncanny instinct, and they may be seen leaving the ventilators of a greenhouse in

their thousands when it is being fumigated, only to return in the morning when the ventilators are opened up.

Although cold conditions do not always kill white fly, they become very sluggish and whole colonies may be wiped away during the early morning by gently rubbing the fingers over the undersides of the leaves. If this method is used daily during early spring, much can be done to keep them under control. In a mixed greenhouse, look for them under the leaves of Abutilon, Fuchsias, Scented Geraniums and Cucumbers, and generally under the leaves of all plants that have a distinctive smell.

Control.

A mixed house is far more difficult to clear than one used entirely for tomatoes, as with a mixed house no wholesale destruction of white flies is possible by burning Sulphur, or using Cyanide preparations at the end of the season. This end of season fumigation with sulphur pretty well wipes out all traces of white fly as it kills vegetation as well, but whenever possible this drastic fumigation should be carried out, as it at least ensures a clean start.

Bought-in Plants.

It is time well spent to examine the underside of the leaves of "bought in" tomato plants for traces of white fly eggs and scales, which look like small white blisters. Badly infested leaves should be removed entirely, but the eggs on lightly infested leaves can be squashed by rubbing them with the fingers.

Sprays.

Few sprays are effective against white fly, because of the difficulty of thoroughly wetting the waxy covering on the body and wings, also to the difficulty of complete and absolute wetting of the leaf surface.

Even the dipping of some plants does not give 100% protection, and as this pest breeds so quickly under favourable conditions only partial control is secured by this method.

Any sprays used should be of an oily or sticky nature, one which either sticks the fly to the leaves and seals up the egg cases, or one which penetrates the waxy covering of wings and body. A spray of the light oil emulsion type is one of the best for this purpose.

An effective home made spray can be made by mixing a teaspoonful of good quality heavy lubricating oil with two ounces of soft soap until it creams. Pour a gallon of boiling water over the mixture and stir it until dissolved. Apply to the plants with a fine spray while still warm.

A point of interest here, is that sprays can be applied to most plants as hot as hands can be borne in the water. In many cases the efficiency of the spray is doubled by using hot water, probably because fumes are released by the heat.

As spraying is sure to disturb adult flies on the plants they will intelligently wing to safe perches on the stays and framework of the greenhouse, so it will be necessary to spray all parts of the structure as well. An oily spray sticks them to the woodwork.

Always spray on a cold morning when they are heavy on the wing for as the day gets warmer the slightest touch of a plant will cause them to rise in clouds.

During fine weather, the liberal use of a powerful but fairly fine spray from a hose pipe will do much to keep these pests down to reasonable limits. A stirrup or foot operated pump will do this job splendidly in a small greenhouse without splashing too much water about.

FUMIGANTS.

Without doubt fumigating is by far the best method of control, especially in a greenhouse entirely grown over to the cultivation of tomatoes.

Various vapourising liquids of the Tetrachlorethane type are available, but as some of these have a knock down action only, their use should be supplemented by using the hose pipe in the morning to drown or wash the flies down the drain before they have a chance to recover.

Arrange to fumigate the evening before a watering is due as this ensures that the foliage is reasonbly dry, and the morning hose down will serve two purposes. Of course, where no water is laid on, a watering can with a coarse rose or a spreader can be used instead.

D.D.T. smoke and Nicotine cones may also be burned according to the makers' instructions.

Warning. No gas or smoke dangerous to human life should be used in any greenhouse attached to a dwelling house. Whatever smoke is used, it is bound to be unpleasant, and precautions such as putting gummed paper over the cracks should be taken. If there is a connecting door this is doubly important, but if the greenhouse ventilator opens under or near a bedroom window, the results can be just as unpleasant.

WHITE FLY PARASITE (*Encarsia formosa*). Used as a control.

Generally known as the Chalcid Wasp, this small fly keeps white fly down by laying its eggs in the partially hatched out flies under their protective scales. The young chalcid wasp feeds on the white fly, and it is then only a matter of which breeds the quickest, or feeds the fastest. An occasional fumgation starts them off square again.

This parasite does not survive low temperatures and fresh stock may have to be procured each year. The essentials are, a temperature which does not fall below 50 degrees F., a plentiful supply of white fly eggs or scales. When available this parasite may be obtained from the R. H. Society's Gardens, Wisley, for which a small charge may be made. Write first to enquire.

Tomato Moth.

As a rule the foliage of tomatoes is immune from attacks by ordinary caterpillars, but in some districts the tomato moth is a troublesome pest.

These eat anything with a tomato flavour, fruit, green and ripe, leaves, leaf stalks, in fact everything but the string.

As few natural enemies can attack them under glass, a keen look out should be kept for small brown moths fluttering about the greenhouse during the early part of the year.

Fortunately, D.D.T. dust will effectively destroy any caterpillars that it comes into contact with.

Red Spider Mite.

If the greenhouse is regularly washed as advised, and the plants themselves well syringed, there is little danger of this pest becoming established.

Too high a temperature and too dry an atmosphere encourages them more than anything else. Spraying with Volck is generally effective.

Soil Pests.

Among the more serious are Wireworms and Leatherjackets. These are generally carried in with new soil from old pastures, but can also come into the soil in greenhouses by burrowing under the walls.

Wireworms are the dirty white larvæ of the Click Beetle, and as they take up to five years to turn into beetles from the egg, they can be a menace for years.

Soil sterilising powders give a certain measure of control, and of late years these have become very effective. The most effective way is to trap these pests by using pieces of carrots or turnips on sticks like toffee apples. Avoid using potatoes for fear of any virus infection. Place the baits along the rows of plants, and examine them every day if possible, pulling out the tough wireworms and destroying them. A few grains of corn sown in the soil will attract wireworms as they prefer this to tomato plants, when a wheat plant falls over, dig it up and extract the wireworms.

The same advice holds good for leatherjackets. Firm planting reduces the danger of attack as both wireworms and leatherjackets prefer to travel through loose soil rather than force their way through firmly packed soil. The advantage of firm soil can be lost if the soil round the collar of the plant is flicked by the trowel to make a tidy job. The writer has often seen them moving through this soft shallow layer to attack the succulent stems.

Woodlice

These generally do more damage to seedlings than to full grown plants in their permanent quarters.

A toad is the best destroyer of woodlice that I know and another natural "remedy" is the Centipede.

All crevices in brickwork should be filled with cement, and no decaying wood or other material should be left lying about in greenhouses.

Mix equal parts Dried Blood and D.D.T. and dust thickly under heating pipes or seed boxes.

12

PHYSIOLOGICAL TROUBLES OR DISEASES

IN spite of this high sounding name, a disease which comes under this heading would be more truly described as bad cultivation, and the two most important physiological diseases of tomatoes are Blossom End Rot and Dry Set.

Both these troubles can cause a serious loss of crop, and it is not too much to say that Dry Set is responsible for an average loss of at least two trusses—generally the fourth and fifth—on nearly every tomato plant grown.

In spite of good advice this trouble is not so easy to overcome as some writers and lecturers would have us believe. My own experience is that the smaller the greenhouse, the more difficult it is to prevent.

Concrete paths in small greenhouses contribute more to this trouble than is realised, and plants in smart new greenhouses with concrete paths, edgings and benches often suffer far worse than those in old derelict greenhouses with earthen or ash covered floors.

On an average, paths in a small greenhouse occupy about one third of the floor space, and if these are made of concrete they get very dry where exposed to hot sun, and they take a great deal of water out of the atmosphere. Whereas a damp ash or earth path will give up moisture into the atmosphere of the greenhouse by evaporation. This is trapped in the greenhouse for the simple reason that it cannot easily get out.

The dryness of the air is not so serious in the winter time, as although excessive fire heat will dry out concrete,

he natural dampness of the winter atmosphere will ompensate for its loss.

These statements can be simply proved by spraying a quare yard of concrete path in a greenhouse with a yringe full of water during a sunny day, when it will be ound that one square yard of concrete will absorb a yringe full of water every ten minutes.

Dry Set.

Dry Set may very often mean no "Set" at all, and the mbryo fruits contained at the base of the flower will not well, and the whole may even drop off if the seeds inside he fruit are not fertilised.

All normal tomato flowers when fully open have a omplete fruit tucked away in the petals, so complete hat even the seeds are in position.

Tomato flowers are self fertile which means that the ollen from any given flower will fertilise itself, each lower being complete in itself, and when each flower is ully open is waiting to be fertilised as a result of pollen- tion. That is, the transfer of pollen from the stamens to he little knob or stigma which is visible in the flowers.

This little knob—which looks like a miniature hat pin—is ticky and both moisture from the plant and from the air is ssential to keep it so. Just as moisture is necessary to make um sticky, so moisture is necessary to keep the stigma in a uitable state to retain the pollen grains as they fall on it.

As a flower only remains in a suitable condition for ollenising for about 24 to 36 hours depending on pre- ailing conditions, any neglect must mean the irretriev- ble loss of a fruit under natural conditions.

If only one fruit on every plant is lost during a period f 36 hours, it will be readily seen how these losses can ount up in the course of a normal fruiting season.

Dryness at the Roots.

It has been stated that plant moisture is just as necessary as atmospheric moisture, which means that the plant must never be allowed to become dry at the roots at any period of their growth.

Fig. 30.

To show relative position of calyx, which is actually behind petals.

A. Petals. *D. Stigma.*
B. Calyx. *E. Stamens.*
C. Embryo Fruit.

Attention should also be paid to the feeding of the plants especially at this period of growth, as the development of four or five trusses will have already placed considerable strain on the plant, and extra assistance is required.

Blossom End Rot.

This disorder is more generally met with during the early part of the year and on the earliest formed fruits.

In many cases, the first sight of this trouble is what appears to be a few nice little tomatoes ripening earlier than others, but on examination it will be found that this reddening is only on the outer edges of a sunken brownish patch on the blossom end (as opposed to the stalk end) of the fruit. If these affected fruits are cut open it will be found that pulp immediately under the sunken patch may be a very dark brown or even black.

This disorder may be due to one of several reasons or a combination of all of them.

Firstly, the plant may be growing rapidly and has reached a stage when more water is needed by the plant than can be taken up by the roots, either because of the soil being too loose, or because of neglect in watering.

As plants in boxes, pots, or on benches are affected most

by this trouble, the shortage of water may be due to the inability of the soil in the pot to hold sufficient water long enough for the roots to take it up or because the soil has been allowed to dry out, and any water given subsequently has run down between the pot and soil and has not wet the ball.

No amount of feeding or dosing will cure this trouble, but it will soon rectify itself if mulching and watering is attended to.

If this is done straight away no further trouble need be expected. Nature has all sorts of ways of maintaining a balance and when a tomato plant finds itself short of water, it will suck enough moisture back from the fruit to maintain sufficient in the plant, and this is what happens in the case of Blossom End Rot.

Curiously enough plants which have received sufficient water and then allowed to suddenly dry out are more prone to this trouble than plants grown dry all the time.

Blotchy Ripening.

This is another fruit trouble, and one which has been attributed to all sorts of reasons.

Shortage of Potash is a contributory cause, but the hard green, white and yellow and orange patches are more often due to cold wet soil conditions as well as to sunburn.

This sunburn may take place days or even weeks before the damage shows itself as waxy like discolourations. It will be noticed that this blotchiness is more pronounced on plants where the fruits are exposed to strong light, and the burning effect of bright sunlight.

If a lot of leaves are cut off the plants, this will expose the immature fruits to the burning rays, especially when fruits are near the glass where the air may be stagnant.

This disorder is seldom troublesome on outdoor grown plants.

Green Back.

This is different from blotchy ripening, in that the fruit turns red with the exception of a well defined hard green area near the stalk.

Again shortage of Potash may be a contributory cause, but bright light as distinct from hot sunshine is more often the real cause. Greenbacks are seldom found under the shade of the leaves, and are more general on the rows near the glass or on rows bordering paths.

It cannot be emphasized too much that defoliating is responsible for many ills which are often attributed to other causes.

Small growers and private gardeners should on no account model their methods on market growers, who often grow different varieties, and use methods which suit their own trade needs, but which may be at variance with their own purely gardening instincts and training.

Virus Disease.

A virus is a poison, and although virus diseases have been identified and named, their symptoms and appearances vary according to the variety and the age of the plant.

So variable are they that even experts may be misled as to the exact nature of the disease as displayed by the plant, that the exact disease can only be determined in the laboratory.

The layman may take it however, that any unnatural colouration of the foliage and the collapse of stem or foliage is due to some form of poison which has got into the system of the plant.

Discolouration due to lack of some minute traces of an obscure mineral is not a serious problem for the small grower, except under rare conditions, and may be disregarded if good culture is maintained.

When such signs can be seen, it is pretty certain that the disease has a firm hold, and as the poison is inside the plant itself external applications cannot do much good.

It is also fairly certain that many of these poisons cannot get inside the plant except through the skin of the plant, just in the same way that we seldom get blood poisoning without puncturing our skin.

The effect of these viruses or poisons inside the plant is to prevent the free passage of plant food from cell to cell, either by causing the passages to close up, or by killing the healthy tissues.

In some cases the stem tissue at soil level is diseased, while the part above it remains healthy and unless more roots can be induced to grow quickly from the stem above the diseased portion the plant will soon die.

The only real protection against virus disease is to build up a well balanced healthy plant, and to see that no damage is caused to the outer skin, either by tools, cutting or breaking of leaves, and the many other ways of hurting the plant.

Insects too may transmit diseases of this kind, either from other diseased tomato plants, or more commonly from other plants which are grown in the same greenhouse.

If for any reason foliage has been drastically removed, shade the glass by spraying with flour and water or Summer Cloud as this will minimise the danger of many of the diseases which may attack tomatoes.

In districts of great light intensity, laths placed on the tie bars of the greenhouse will produce ideal light conditions. The gap between the lath should be as wide as the lath itself, and although during wood shortage this may not be a practical method of shading, it is one which is well worth keeping in mind.

Types of Virus Diseases.

Mosaic.

This disease causes a mottling of the leaves, and the degree of yellowing usually indicates the severity of the attack. In the case of a mild attack a crop may be taken from the plants. The fruits may be blotched and unattractive, but are safe to eat.

The danger lies in the fact that insects or the knife or hands of the operator may convey it from one plant to another. Therefore it is wiser to remove carefully the entire plants when first observed.

The application of fertilisers is often recommended for attacked plants, but it should be borne in mind that there is absolutely no evidence to show that this acts directly on the virus infected plant. The main job is to make the constitution of the plant strong so that it can resist the effect of the poison and this is not necessarily done by applying fertilisers. It may be that more congenial growing conditions would give better results. The best analogy that I can think of is that rheumatism is not *caused* by wearing damp clothes, but these conditions will reduce the bodily resistance and create the necessary conditions for rheumatism to assert itself.

The strength of the body or plant is the best safeguard against disease.

Potash and in particular Sulphate of Potash applied to the soil and washed in will help to harden and balance the growth, but its use must be governed by the treatment which has already been given, and the material which has has been dug into the soil during preparation.

Streak or Stripe.

This is probably the most common disease found in the

small grower's greenhouse and an affected plant is easy to spot.

The fruit takes on a yellowish orange tinge often blotched with paler colours, the leaves hang limp and the upper part of the stem runs out very thin. Pull such a plant or plants up at once, burn if possible, and on no account use the string or stakes again in a greenhouse for tomatoes. Take out at least a ten inch circle of soil fully six inches deep, and fill the hole with clean soil. Carefully wash the hands before re-entering the greenhouse. On no account do as I found one chap doing—carefully washing his hands in the water tank in the greenhouse.

It is best to destroy an infected plant entirely, rather than leave it in the greenhouse as a source of infection for the sake of the miserable crop it will produce.

Soft flabby overgrown plants may be given Potash, but little else can be done at this advanced stage.

The writer has carried out some interesting and successful experiments on hypodermic injection of the plants, but much remains yet to be done in this field.

There is little point in cataloguing all the virus diseases, and even the mere identification serves little purpose. Once the signs of disease appear, the plant is usually too far gone to do anything except destroy it. When a whole house is affected, the only thing to do is to shade the plants by painting or spraying the glass with flour and water, raise the temperature and the humidity of the greenhouse, and get as much ripe fruit off as possible, making sure of a clean start by thorough cleansing before next season.

Fungoid Diseases.

These diseases are more general than virus diseases and embrace the moulds and the mildews, such as Botrytis, Cladosporium, Canker, etc.

These may be primary or secondary diseases, that is, they may come as a result of bad cultivation, following damage to plant tissue, climatic or weather conditions, or simply out of the blue.

As with all diseases the best "remedy is prevention" by maintaining a healthy well balanced plant, good ventilation and common sense treatment.

Grey Mould or Botrytis Stem Rot.

This is a grey furry looking mildew which appears on cut and broken surfaces of stems and the stumps of leaves, and the spores may often fall on the back of tomatoes causing the calyx to rot and may ultimately eat into the fruit itself.

Under suitable conditions this disease may work backwards from an infected leaf stump, and working upward and downward in the stem entirely kill the plant.

Warm muggy conditions favour the spread of this disease and its very presence often indicates that insufficient ventilation has been given. The best preventative is a free circulation of air and the foliage should be so controlled in size that the air can circulate freely through and around every part of the plant.

Where leaves have to be removed because they have grown too large, the entire leaf should be removed by pressing with the flat of the hand in an upward direction near the junction of the leaf with the main stem. Only sufficient leaves should removed to allow of the circulation of air. On no account should leaves be cut off leaving a stump. The operation of defoliating should be done during a hot dry period.

Fortunately it is possible to control this disease if tackled at an early stage. If the disease has already caused the decay of stump and portions of leaves, these

infected portions should be carefully and gently removed, so as not to disturb the spores which will fly all over the place. Drop these into an old tin and then paint the infected parts with Liver of Sulphur paste. Good results can also be obtained by using dispersable Sulphur mixed to a thick paste and applied with a soft brush.

Didymella or Stem Rot.

This is a virulent disease and will quickly spread through the greenhouse. Whilst its origin is obscure it often occurs through the use of strings, stakes or even seed boxes which have been previously used for tomatoes without being sterilised. This disease can occur in remote country districts far removed from other tomato plants, but in every case investigated, soil or turf from a poultry run has been used. This would suggest unbalanced soil due to excess nitrogen. This disease can often occur as a secondary infection following damage by boots or clogs, the rough usage of the watering can or hose pipe. There is no known cure for this disease.

Leaf Mould or Cladosporium.

This is by far the most common of fungus diseases of the tomato, and its spread is favoured by the same high temperature and muggy conditions inside the greenhouse. Plants which have been grown under cool conditions and then have suddenly been warmed up by closing the ventilators during a comparatively cool spell are more susceptible. Less risk would be run if the outside climatic conditions had been ignored and the ventilators kept open, as the writer has yet to see tomato plants take any harm when exposed to cold conditions in mid-summer. The only result of this continuous free ventilation is that picking is slowed up, which is not of such serious consideration as the risk of losing a third of the crop from disease.

Spraying with Dispersable Sulphur and Colloidal Copper Emulsions and dusting with finely divided green Sulphur will reduce the risk of this disease, and will give a measure of control after attack. In areas which are prone to the annual visitation of this fungus disease, mould resistant varieties such as Vetomold should be grown. During summer fogs, ventilation should be reduced to the minimum, and where possible fires should be lighted to create an upward movement of the inside air, so raising the buoyancy of the air inside the greenhouse.

Blight.

This disease is more generally found on outdoor grown tomatoes than in the greenhouse, but if both are grown it may be found that the disease is transmitted from one to the other. A white downy fungus appears on the under part of the leaf, which develops and causes dark purple areas. The fruit is also attacked and pitted dark brown patches appear.

Spraying with Bordeaux mixture or dusting with Bordeaux or Colloidal Copper Dust will prevent and check the spread of the disease. Care however, should be taken in or near large industrial towns where the application should be half the recommended strength. Fortunately the disease rarely attacks plants in these areas, due no doubt to the heavy precipitation of sulphurious compounds.

This disease may be carried in a dormant state from the seedling stage, and may only appear in a virulent form when conditions are right, but any seedlings which are known to have come from boxes infected with Damping Off disease should be carefully watched.

Buck-Eye Rot.

This is often confused by the amateur with Blossom End Rot but need not be, as "Buck-Eye" rot is first seen

a distinct brown circle around the point where the scarded flower is usually found and not as a depression that area. This is caused by a soil organism and is ually found only on the bottom trusses, especially where atering is done with a powerful hosepipe so that the soil splashed among the fruit.

UMMARY AND CONCLUSION.

It will be seen by the foregoing notes that little can be one for tomato plants once visible signs of affection by sease is detected. It is therefore of the utmost importnce that the attitude of the grower should be one of efensive measures. The best of these being good ltivation, hygienic conditions, the use of common sense. Fungoid diseases however, if tackled at an early stage ay be controlled.

13

GROWING TOMATOES WITHOUT SOIL

WHERE soil is not available, or if anybody cares to try an unusual method of growing tomatoes, water or sand culture provides an interesting hobby.

Interesting because much can be learned about the food requirements of soil grown plants in this way.

No expensive apparatus is required even to grow a considerable number of plants, and in its simplest form may consist of nothing more than a plant pot full of clean sand.

Whatever containers are used for sand or water, the most important thing is to see that they are clean and sterile. Cleanliness in this case means not only free from dirt, but as clean as a surgeon's instruments. The reason is that everything used, the water, sand, containers, etc. must not add any substance accidentally.

For example, ordinary sand unless thoroughly washed is almost certain to contain such substances as lime or iron, which even in minute quantities are liable to affect and upset the other ingredients.

On no account should zinc or galvanised vessels be used, as the corrosive acids used may dissolve some of this off the tanks or containers and poison the plants. So small a quantity as one part in a million is harmful to the delicate roots of the plants.

Methods.

There are several methods which the writer has used successfully, and the choice of the particular method must

epend to a large extent on the facilities available, and the umber of plants it is desired to grow.

Where a large number of plants are to be grown, it is ssential that a good supply of clean tap water is at hand.

The simplest form of water or nutrient culture is to use 10 inch pot which has been soaked in water for at least 2 hours and then thoroughly scrubbed.

Place some clean crocks over the bottom to cover the rainage hole, more to prevent the loose sand running out han to improve the drainage.

Fill the pot to within an inch of the top of the pot with lean well washed sand—coarse silver sand for preference.

But where sand is not available, fine washed coke breeze, nely crushed clinker or boiler furnace ash may be used.

Ash from coke fires should not be used, but the crushed linker is suitable if it is more than 12 months old. All hese materials should be as free from any chemicals as vashing can make them.

Stand the pot or pots in ordinary earthenware saucers, nd they are ready to receive the young plants.

Here again, if the young plants have been raised in soil, his must be thoroughly washed off by repeated dipping n water. While this is being done, great care should be aken to see that no damage is done to the fine root hairs.

Of course, wherever possible, it is better to raise the lants in sand fed with nutrient solutions and then trans- erred to their permanent quarters in the bigger pots.

After putting the young plants in the fruiting pots give he sand or ashes a thorough watering with clear water, nd allow this to stand in the saucer after it has drained hrough the pot until it has been reabsorbed by the naterial in the pot.

Subsequent treatment consists of watering with nutrient olutions made as described at the end of the chapter.

It is not advisable to have the saucer in which the pot is standing too deep, because if the solution or water is not reabsorbed by the sand or material in twenty-four hours, this should be emptied away. The next watering should be timed so that the material never dries out.

To make sure that this never happens, a gallon or half gallon stone bottle can be filled with solution and connected with a tube of rubber, so that a steady drip is directed on to the sand.

Similarly, an overflow can be arranged so that not too much solution builds up in the saucer underneath, as it is just as important that air should move freely in the sand or ashes as it is in soil. No top dressing is necessary, and no organic manure or mulch of any kind should be used. The possible exception being granulated peat which is an inert material.

Still Tank Method.

This method is not generally used now-a-days because of the labour and trouble involved in ærating the water, and the difficulty in obtaining the material for making the trays.

These should be made of wood or concrete, metal trays are not suitable because of corrosion which is sure to take place unless it receives several coats of bitumen paint. It is really extraordinary how quickly a weak solution of acid will rust or corrode metal, in fact, it seems that the weaker the solution the more quickly it will rust.

Trays or boxes should be of a size to be easily handled, and should not be more than five inches deep—inside measurement—nine inches to a foot wide, and about two feet six inches long. This enables the grower to take these out of the greenhouse, or shift them about so that they can be thoroughly scrubbed out after use.

This method also requires a wire grid of not more than a alf inch mesh to fit over the top of the tank to support the ants, so that the roots can hang into the liquid. This ould be stiff enough to prevent it sagging with the weight the plants, and is best secured to a wooden frame. Vire netting should not be used for this purpose unless it ceives two or more coats of bitumen paint as the alvanising material is zinc, which is poisonous to plants fter being attacked by the weak acid used.

Concrete tanks should be well soaked in water or have ad water contained in them, for at least three weeks before eing used, then dried out and painted with bitumen aint. Wood tanks can be painted straight away with ny good quality paint, but here again it is found that itumen paint is the best preservative, and contains othing harmful to the plants. On no account should reosote be used for preserving the wood.

ETHOD OF OPERATION.

To make the tanks easier to operate it is best to fit a rainage plug to the bottom part of the tanks, as this nables the liquid to be drained off periodically without isturbing the root system in the tanks. Alternatively, the ater can be siphoned off with a short length of hose pipe.

Fill the tank up with a nutrient solution to within half n inch of the bottom of the grid, and place the tomato lant at about nine inches apart on the grid with the roots anging into the liquid. The best plants to use are those hich are about half the size normally used for planting ut into soil, and if these have been grown in soil this ust be washed off. The smallest amount of soil quickly uls a tank used for nutrient solutions, and the greatest are should be taken to remove it entirely by repeated ppings in water.

After the plants are in position they should be kept erect by carefully placing wood wool round the stems, entirely covering the grid. This packing not only serves to keep the plants erect but keeps the light from causing green algea to form on the water. Large gravelly stones which have been washed clean can also be used for this purpose, and the writer has used shingle collected from the seashore. These have the advantage that they can be used time and time again after being rinsed in clear water.

The most important lesson to learn in water culture especially with the still tank method is that none of the nutrients are lost, if they are not taken up by the plant, they must remain in the tank, and as the amount actually taken up by the plant is extremely small, they can soon build up to the point when they are not nutrients but poisons. To get over this danger, it is necessary to drain the tank every four weeks, and fill it with clear water and allow this to remain in the tank for at least twenty-four hours.

All this sounds very complicated, but if a drainage plug is fitted and a water tap is handy, it is only a matter of minutes to flush the tanks.

Aeration.

With the still tank method it is necessary to ærate the water in the same way exactly as gold fish tanks are ærated, but if only a small number of plants are grown, an ordinary garden syringe will do. In fact, a bicycle pump answers very well for this purpose. Blowing down a small tube is even better, because the small portion of carbon dioxide from the breath seems to have a beneficial effect on the plants. Aeration should be done at least once a day.

RAINING.

Plants can be trained up string in the ordinary way nd need present no difficulty, as the strings may be tied ound the stem of the plants without fear of them being ulled out of the tank.

Routine work consists of seeing that the liquid is kept opped up to a level at which the water was first put in, ushing the tank every month.

ROWING IN AGGREGATE.

In my opinion this is undoubtedly the best method, nd crops comparable in every way with soil grown lants can be had with very little trouble and outlay. In everal parts of the world such crops are a commercial roposition. Tomatoes lend themselves very well to this nethod of cultivation as larger tanks may be used and torage tanks for the nutrient solutions can be installed, s well as time switches and electric pumps to circulate he solutions through the aggregate.

Aggregate is the name given to a gritty material which s neither properly sand nor gravel but contains a fairly ven proportion of both. This material is at the same time pen, yet fairly retentive of water, so that if it is soaked nce during the day, it can be allowed to drain for about ight hours before it need be flooded again.

Advantage can be taken of gravity feed from one level o another, and tanks to hold the aggregate may be rranged in terraces, so that the nutrient solution only eeds to be pumped up to the storage tank.

This system can of course be modified to suit any onditions or the quantity of plants it is required to grow.

With this system the water containing the nutrient or lant food is filled into a storage tank above the level

of the growing tanks, which are filled to the top with clean aggregate.

The water runs into these, and when filled, a valve is set so that when the first growing tank is full it automatically drains into the next one and so on. Finally it drains into a storage tank at a lower level, from which it is again pumped to the high level gravity tank.

The times of flooding depend entirely on the weather, time of the year, and type of crop being grown. For example, during dull weather or during the winter months, it may be sufficient to saturate the tank once or twice a week, yet in the summer time when the sun is bright and water losses from both plant and aggregate are considerable, it may then be necessary to irrigate two or three times daily.

Irrigation is a matter entirely for individual experience and if nothing else is learned, the study of the needs of a tomato plant will have been well worth the while.

Generally speaking, however, active growth is bound up with long hours of daylight, and bright light (not necessarily bright undiluted sunshine) but bright days.

It is on these days that the food making cells of the plants are most active, and more water and food making materials are needed than during dull damp sunless days.

At no time must it be imagined that soilless culture is a lazy method of growing plants. Control is essential at all times, and the grower must be quick to detect and recognise any nutritional deficiencies. He must also learn how to correct these without destroying the essential balance of the plant nutrients, as this will only tend to swing it the other way so that a deficiency may end as an excess.

It will be found that growth is more rapid in aggregate than in soil due to warmer and better ærated root

onditions, and provided that the utmost care with egard to cleanliness is maintained the crop will be emarkably free from disease.

The cultural requirements of the crop are exactly the ame as for soil grown plants, except of course that the abour of watering is entirely eliminated.

Earlier support by stringing is generally necessary more han for soil grown plants, and plants should not be llowed to fall over for want of staking. Do not use canes which have been used in soil.

Manures.

It is very important that no manures such as Dried Blood, animal or poultry manure or anything of an organic nature be used, as this will start bacterial action. No matter how desirable this may be in the soil it will spell disaster in water culture.

Mulches of manure or any other material should not be used on the surface of the rooting medium.

Plants.

These should be raised in a sterile medium, such as pure sand or the new mica derivative "Vermiculite." The plants can then be transferred to the fruiting beds without root disturbance, as happens when the plants are washed in water.

Planting Out.

The leaf area of the plant is generally less than in soil, with the result that the plants may be planted more closely together than in soil, and a profitable distance has been found to be 15 inches each way in both plant and row.

The actual planting is a simple operation, and consists of making a hole with a pointed stick in the peat or ashes big enough to accommodate the roots, covering these again in the ordinary way with the hands.

More control can be exercised under soilless culture than in the soil, and slight adjustments may be made if too much leaf is being made.

These few notes must not be regarded as the last word on tomato growing without soil, but they may encourage the grower to experiment and seek further information on plant nutrition, if only to assist him in growing better plants in his soil.

The writer has had 12 years' experience in growing a variety of plants without soil, and can vouch for the fact that excellent crops of tomatoes can be grown without it.

In concluding this short chapter it need hardly be said that in this country at any rate, water culture under glass is essential owing to dilution caused by rain.

Warmth is another factor, and most important of all, plenty of light is necessary.

Water.

Tap water should always be used, as rain water often contains many impurities, and in or near large industrial towns may contain the so-called " trace " elements in too large quantities.

Tap water varies of course from area to area, but does not appear to have a serious effect on the nutrients in solution.

Preparation of Nutrients.

Formulas. Many formulas have been devised and each have their own merits having regard to the purpose for which they were devised. For example, Begonias may require a slightly different mixture from lettuces. Fortunately tomatoes are comparatively accommodating, but here again temperature of water or aggregate will play a part in the precise formula used, and these notes should serve only as an introduction to this subject.

TRACE ELEMENTS.

These are minute traces of chemicals which play such an important part in the well being of plants. They are of great importance in soil grown plants, and their presence or absence even to the extent of half of one part in a million may make all the difference between the success or failure of a crop.

How to Mix Trace Elements.

These are best mixed separately and kept in a glass stoppered bottle, which should not be exposed to strong light.

Stock Solution.

Dissolve the following in half a gallon of water (in practice ordinary tap water is most convenient, and is not subject to the same variation as "soft" or rain water).

3.2 grams (approximately one teaspoonful) boric acid, manganese sulphate and zinc sulphate. To this solution add one-eighth teaspoonful of copper sulphate. This latter is not absolutely essential, but it helps to keep down any green growth which may form on the water.

Mix all the powder thoroughly together in its dry state, add to the water and shake thoroughly until dissolved.

Fertilising Salts for Culture Solution.

To 5 gallons of tap water add	*Mono-potassium Phosphate KH2 PO4*	*Calcium Nitrate Ca(NO3)2 4H20*	*Magnesium Sulphate MgSO4 7H20*	*Ammonium Sulphate (NH4)2 SO4*
Grams	5.9	20.1	10.1	1.8
Approx. in teaspoonfuls	1½	4	2½	½

Mix these chemicals separately in a pint of water, then add them all together; this quantity will be sufficient to make five gallons of solution.

To each five gallons add four teaspoonfuls of the stock solution, containing the trace elements mixing them in thoroughly.

The trace elements are best added just before using because of chemical reaction.

For anyone unfamiliar with chemicals it may be better at the outset to take the formula to a chemist—now-a-days ready mixed fertilising salts may be purchased in separate packets.

There are any number of formulas available which may be used as recommended or may be modified to suit special climatic conditions when experience has been gained.

The mixtures also give excellent results when applied as a liquid to the soil in the ordinary way.

Many books now exist on this subject, and the reader is recommended to follow up this brief mention, not only for the novelty and interest of growing tomatoes without soil, but to gain a greater knowledge of the type and quantity of plant foods which tomatoes require at different stages of their growth.

14

EXHIBITING TOMATOES AND SAVING SEED

TOMATOES are well represented every year at Horticultural Shows, but the quality often leaves much to be desired ; this is often due more to lack of experience and knowledge of presentation than inability to grow the fruit.

Preparation of the fruits for an August show starts early in the season, the fruits for exhibition being selected when they are little bigger than marbles. Certain varieties form their fruits in fairly tight clusters on the trusses, and if all the fruits are allowed to remain, the pressure of one fruit against another as they swell is bound to push one or other of them out of shape. Good judges assess exhibits on their being true to type, that is, having all the characteristics of the particular variety.

For example, Stonors M.P. has a definite squareness of shoulder, and is flatter in appearance than say, Stonors Exhibition. Space for development should therefore be allowed so that each fruit can develop to its full and natural size. Large fruit cannot reasonably be expected from plants or varieties which by their very nature produce only small fruit. For example, Carter's Fruit or Potentate produce fruits of immense size whilst Harbinger and other early and smaller varieties would never attain to large size under any cultural conditions. All the more reason therefore that the varieties should be carefully labelled, so as to assist the judges in making a true decision and assessment of the merits and qualities of the exhibit.

As the time of the show draws near, selected fruits should be allowed to remain on the plant, removing only those needed for the house, and great care should be exercised when watering. This should be regulated so that the soil is never allowed to dry out, otherwise the first watering after the soil has been allowed to dry will cause the fruit to crack. Care should also be taken to see that no water or liquid manure splashes on fruit hanging on the lower trusses, as this will cause blemishes on the skin which cannot be removed.

If a selected fruit is hanging so that one side is pressing on the main stem or a leaf stalk, it should be carefully tied away or a thin pad of cotton wool placed under it, so that the pressure does not cause any indentation of the now softening fruit. On no account should the fruit be touched with the bare hand, and all operations such as tying up the trusses should be performed by looping soft string or raffia round the truss stem and pulling gently to the desired position. If it is necessary to touch the fruit, then old cotton or woollen gloves should be worn. Do not allow the fruits to become over-ripe as the dark redness of over-ripe fruits will lose as many points as under-ripe fruit. Over-ripe fruits can be easily detected by their dark red bloated look. These should be discarded but need not be destroyed as they are ideal fruits from which to save seed.

In northern and north-western districts a period of bright dry weather may be followed by dull damp periods when the atmosphere becomes charged with moisture. This can cause the wholesale cracking of ripe fruit, but may be prevented by placing one drop of pure Olive Oil on the shoulder of the fruit, and allowing it to run to the point where the stalk enters the fruit. This will give the skin the necessary elasticity to compensate for the slight

swelling caused by the damp atmosphere. The oil will in no way harm the fruits but all traces must be removed before placing it on the show bench.

Preparing the Fruit.

The fruits should be gathered the evening before the day of the show, and if the day has been a hot one the time of gathering should be delayed until the fruit has had time to cool down naturally. This is quite important, as heavily fed fruit, plump and well charged with moisture can easily burst during the last vital twelve hours.

Always handle the fruit wrapped in a soft cotton cloth or with cotton gloves, as the temperature of the hand can affect the fruit. When gathering, on no account remove the stalk from fruits intended for the show bench, as the condition of the calyx (the green star shaped growth attached to the stalk) is a true indication of the freshness of the fruit, and when wrapping care should be taken to see that they are not bent or distorted in any way, as a bend or break at this time will result in black lines across the green.

Grading.

This must come before the final preparation of the actual fruit, and takes the form of placing the required number of tomatoes in groups of exact sized fruit. It is essential that if four or six tomatoes are required by the schedule, that they should be of identical size, and no amount of juggling to obtain an optical illusion will escape the eye of the expert judges. They have seen too many tricks to be deceived in this manner.

For "Six" tomatoes, at least twenty to twenty-four fruits should be available from which to select them. Start off by placing several thicknesses of soft cloth on a

flat bench or table then grade the fruit by placing them in sixes thus :—

O O
O O A.
O O

O O O
O O O B.

O O O
O O O C.

It will most probably be found that the A group standard is too high, as it may contain one or more fruits much larger than any of the remainder. Permit yourself one regretful exclamation that " It's a pity they weren't all that size," and ruthlessly discard these odd

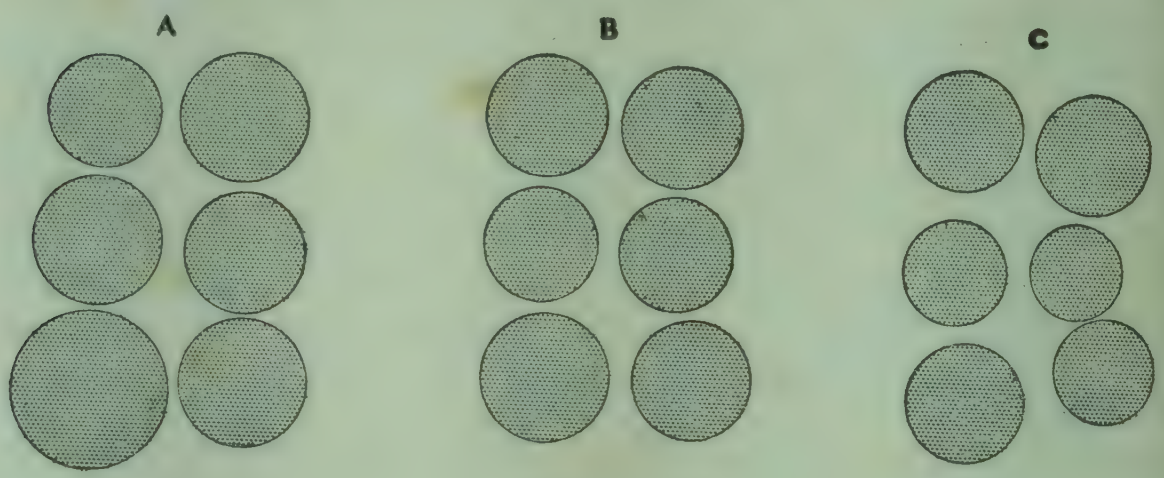


Fig. 31.

over-sized fruits. Match up the A group by taking some from B and C, making up their losses from the reserve. Continue this grading until the A group are perfect in size, shape and colour.

All movement of the fruit must of course be done as gently as possible, grasping the fruit bodily and not between the finger and thumb as this will bruise the flesh. During this handling the stalks should always remain uppermost to prevent any accidental damage to stalks or calyx. Now turn the fruit carefully over so that the fruit rests on the stalk and calyx taking care that the star shaped calyx does not become bent or damaged by the weight of the fruit. Now examine the face of the fruit

for blemishes, which may have been caused by the remains of the pistil, which is often shown as a black irregular spot.

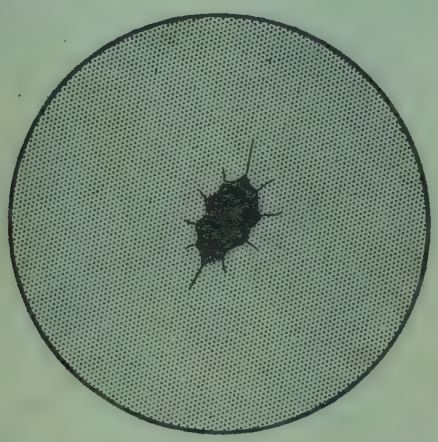


Fig. 32.

A perfect fruit should show no trace whatsoever of this blemish, but if perfection cannot be obtained, then try to find fruit with as small a spot as possible. A large black area even on one fruit will lose you points.

Do not deceive yourself or attempt to deceive the judges as to relative size by arranging them like this :—

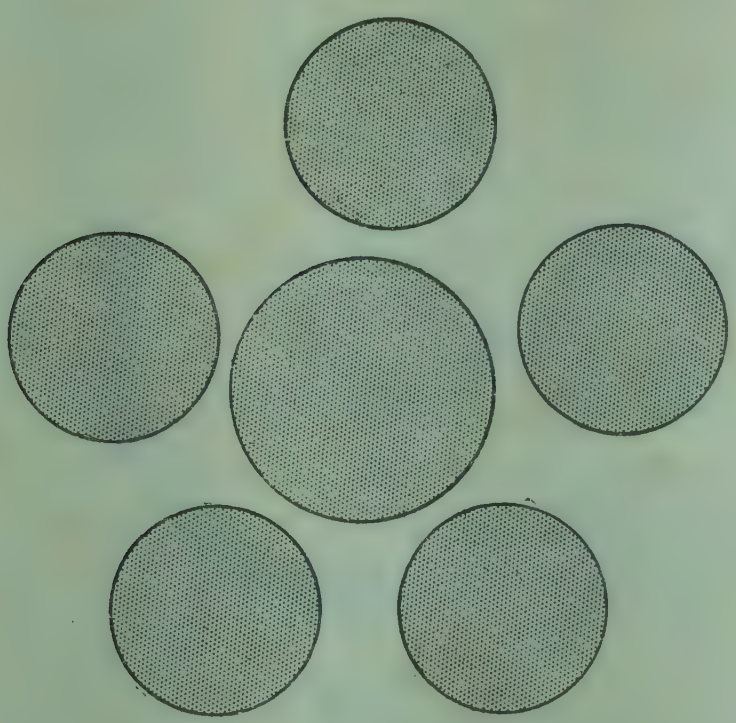


Fig. 33.

or like this :—

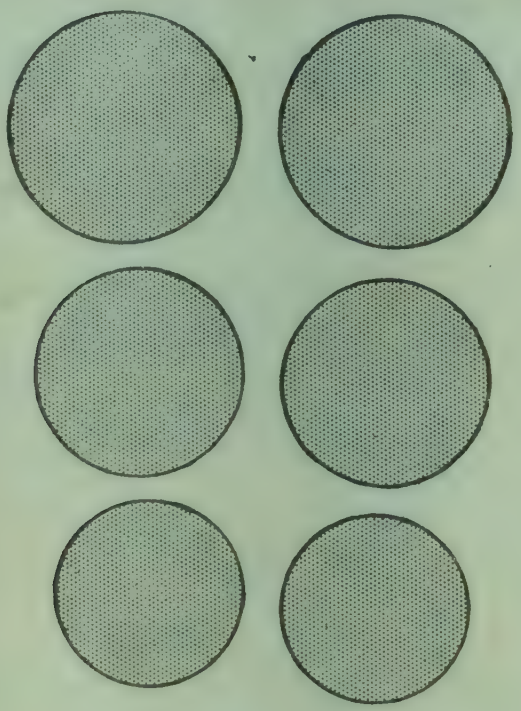


Fig. 34.

They are familiar with all the tricks and it only needs a movement like this to place them in their proper relationship.

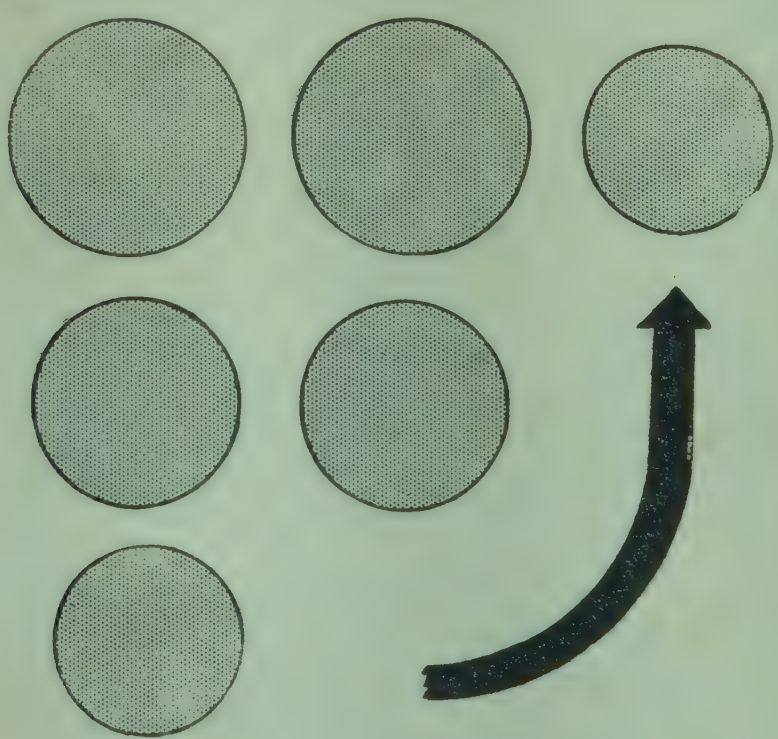


Fig. 35.

The contrast makes them appear worse.

Rely on six perfectly shaped fruits even if slightly on the small side and true to type, rather than by trying to show the judges that you can grow at least one big tomato. Remember that the judges are judging on your six fruits as presented, and are not interested in your growing abilities

After the number of fruits required by the schedule have been selected wrap them carefully in oiled or soft tissue paper. Do this by placing the tomato stalk downwards on the paper so that when the wrapping takes place the calyx is folded to the shoulders of the fruit. This prevents any damage to this all important organ.

Place the wrapped fruits on a bed of cotton wool in a box or flat bottomed basket with a tuft of cotton wool between each fruit, and place in a dark cool cupboard. Do not rely on the exact number, but put in three to four carefully selected fruits, as a reserve. Finally, write or print a neat cardboard or stiff paper label showing the variety, a suitable size is three inches by one inch.

Staging.

Tomatoes are usually scheduled as "A dish of so many tomatoes." The dish can be a paper d'oyly, plate or dish, but the most practical "dish" is a round paper or papier mache dinner plate.

On the morning of the show set up your plate, and carefully place the fruits calyx side downwards, as this sets the dish off better, the judge can be relied upon to turn them over whichever way you may place them.

Use one or two leaves of parsley to decorate the plate, but do not attempt to hide any defect by carelessly allowing a frond to drape over it. A judge who has to compete with exhibitors loading cabbages with shot or stitching roots on bought celery is not likely to be

deceived by such an amateurish device. Place the label in position and if necessary secure it with a pin to the plate.

It sometimes happens that stewards have to make last minute adjustments to the staging, and a plate with label attached is more likely to arrive in its new position intact than loose d'oylies and labels.

There is nothing more you can do except to keep your fingers crossed and trust to sound judging. There are few greater thrills than to walk up to the table a few hours later to see the coveted card on your exhibit, even if you do approach them as if you hadn't got an exhibit.

If you are not satisfied about the judging, don't moan about it, but seek out the judge and ask him why. He is there to help, and most show regulations stipulate that the judge remains available for several hours after judging. Use his experiences.

Saving Seed.

Very few varieties of tomatoes can be relied upon to come true to type year after year even if obtained from the same source, and this is no reflection on the honesty of the supplier.

Some varieties are not "Fixed" and are consequently unstable ; for example a variety may be everything that is desired one year, and unsatisfactory the next.

Certain new varieties are very often only specially selected fruits. As tomato seeds are amongst the easiest to save, it is well worth while to save seed from a plant that has everything that the grower demands.

Generally speaking, a plant will invariably produce progeny with the same characteristics as itself, unless it becomes cross pollinated by the chance visit of an insect. This however, is not likely to happen unless several different varieties are grown in one greenhouse.

Superior seed should not be selected with the eye on an individual fruit of fine quality, but from a plant of good habit with well developed, but not over developed flower trusses and foliage. Due regard should also be paid to the shape of the trusses, for example, a single strap truss such as Plumpton King or a large forking truss like Huntsman, or a bunch truss like Stonor's Exhibition.

This is a matter of personal choice however, as these three varieties mentioned are all good croppers.

Select the fruit from the third and fourth truss, as these will be more characteristic of the variety than those from the lower trusses. Not only this, but the seeds from the lower trusses produce a higher percentage of rogues and tricotyledons than do fruits higher up the stem.

Methods of Saving Seed.

Wet Seed.

Wet seed is seed which has simply been left in the pulp of the tomato fruit until it is required for sowing. It is difficult to sow as the pulp sticks to it, but has the merit of very quick germination. In fact, if the tomato is left in a warm greenhouse, the seed will actually germinate in the pulp of the fruit. It should not however, be left until this stage by the inexperienced grower as this is an art in itself.

Dry Seed.

There are various ways of preparing seed one of them by employing weak acids solutions to remove pulp and the mucilage surrounding the seed, but I prefer not to destroy this coat of jelly-like substance. Using the same tray with the perforated zinc over half its bottom recommended for sifting fine soil over the seeds, divide the fruits and scrape out all the seeds with a clean label. When

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